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MARKETING INDUSTRIAL MOLASSES

By B. K. Doyle

Agricultural Economist



UNITED STATES DEPARTMENT OF AGRICULTURE

Production and Marketing Administration

Sugar Branch

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SUMMARY AND CONCLUSIONS

There is opportunity for much expansion of the use of inedible molasses as livestock feed in periods of ample supply. Use of molasses as feed has expanded sharply in recent years while its use for making industrial alcohol has declined. Various factors in the industries involved indicate that these trends will continue in normal years. Other uses for molasses are less important.

In nearly all years, price relationships have made molasses a cheaper feed for livestock than corn on an equivalent feeding-value basis. Also, it is possible for feeders to utilize low-grade hay and roughage by sprinkling the bulky feeds with molasses, further cutting the costs of feeding. The growing practice of using tanktrucks for deliveries of small amounts of molasses to feeders and small feed mixers reduces costs materially, especially for deliveries to points up to about 200 miles distant from a terminal port.

Molasses prices have often been at very low levels for long periods. Surpluses of molasses have created many production and sale problems. Prices have been comparatively high only when, in time of defense or of war, molasses has been required for the production of large quantities of industrial alcohol.

Inedible molasses comprises cane blackstrap, refiners' blackstrap, beet molasses, hydrol (corn molasses), and citrus molasses. It is an important raw material in the production of ethyl alcohol, yeast, vinegar, and citric acid. It is also a primary ingredient in many prepared livestock feeds, is often used as a silage preservative, and is fed in large quantities on farms either in liquid form in tanks or troughs or sprinkled on coarse roughage. Inedible molasses is a byproduct of raw sugar production, cane sugar refining, beet sugar and dextrose production, and citrus canning and concentrate processing. Molasses supplies vary primarily because of variations in the production of these items. Although total mainland molasses supplies have ranged from 271 to 476 million gallons during the last 10 years, supplies during the last 4 years have shown considerable stability and have exceeded 400 million gallons annually. More than three-fourths of the total mainland supply is shipped from Cuba, Puerto Rico, Hawaii, Mexico, the Dominican Republic, and various Caribbean and European countries, Cuba being by far the largest supplier. Mainland production consists of about 70 million gallons of cane and refiners' blackstrap, 35 million gallons of

beet molasses, 15 million gallons of hydrol, and 10 million gallons of citrus molasses.

Significant changes have occurred in the utilization of molasses during the past 10 to 15 years. Molasses consumption in industrial alcohol plants since 1945 has been about 50 million gallons below the 1935-39 average, a decrease from 180 million gallons to about 130 million. On the other hand, molasses use in livestock feeds has increased from about 125 million to almost 225 million gallons during the same period. Utilization of molasses in yeast, citric acid, and vinegar also has shown an increase of about 15 million gallons.

The decline in the use of molasses in industrial ethyl alcohol is even more significant when the increase of more than 60 percent in the production of ethyl alcohol since 1935-39 is considered. The increase in ethyl alcohol production has been more than absorbed by the utilization of ethyl sulphate and ethylene gas as raw materials.

An additional factor that will affect the utilization of molasses as an ethyl alcohol raw material is the competition of methyl and isopropyl alcohol, produced almost entirely from petroleum products, with ethyl alcohol in many of its major uses. The rapid expansion in the production of these types of alcohol in recent years points to a slowing down in the expansion of ethyl alcohol production.

The lack of a large potential future market for molasses in the production of ethyl alcohol indicates that every effort should be made to expand consumption of molasses in livestock feeds. Molasses can be substituted up to certain levels for other carbohydrate feeds for various types of livestock. When fed at recommended levels, the feeding value of molasses is about 70 percent, pound-for-pound, of the value of corn. In addition to its nutritive value, molasses is important because of its ability to make feed mixes palatable and because it makes possible the salvage of feeds, such as oat mill screenings and low-quality hay and roughage, which could not be used effectively otherwise.

Much of the expansion of molasses utilization during the last few years has stemmed from the recognition of the low cost of molasses as a carbohydrate feedstuff compared with grains. On an equivalent feeding value basis molasses was a more economical feed than corn from 1945 to the fall of 1950. During this period feed mixers and farmers made large investments in molasses feed-mixing and direct farm-feeding equipment. By early 1951, when the full effect of the shortage of raw materials for the production of ethyl alcohol for use in synthetic rubber was felt,

molasses prices rose so rapidly in relation to grain prices that molasses was relatively expensive as a feed material. Molasses content of many feeds was lowered and direct farm feeding was greatly reduced.

A few firms producing mixed feed and two companies producing sugar and dextrose have recently placed dried molasses products on the market. These concentrated, easily handled products contain from 40 to 75 percent of molasses in combination with absorptive carriers, such as corn oil meal and bagasse pith. These products are used in feed mixes and in grass silage. The advantages of a product of this type come from the ease of handling 50- to 100-pound bags as compared with 600-pound drums of liquid molasses, ready availability of small quantities of molasses, elimination of trouble and expense in heating and diluting liquid molasses, and ease of mixing with other feed materials.

The principle of marketing molasses in dried form is undoubtedly a sound one and could greatly increase molasses consumption, but so far the cost to users has been about twice that of corn and almost four times higher than the delivered cost of liquid molasses.

These prices stem from the location of processing plants at long distances from port terminals, high outgoing freight rates on the finished product as compared with rates for prepared feeds containing more than 60 percent grain products, and expensive processing and packaging requirements for producing and marketing an acceptable product.

Before sales of dried molasses products can be increased significantly in competition with liquid molasses and other carbohydrate feed-stuffs, it will be necessary to locate plants nearer large feed-consuming areas, and to develop efficient small processing equipment for drying molasses and its carrier agent.

A study of marketing margins and costs reveals that the movement of molasses from offshore and mainland production areas in large quantity in ocean tankers and tankcars to feed mixers is efficient and that little savings in costs may be expected. On the other hand, marketing costs for less-than-carload lots were found to be very high in most instances. In only a few areas were relatively small quantities of molasses being marketed at low cost.

In some areas marketing costs incurred in delivering small lots of molasses are being lowered by the movement of preheated molasses in insulated tanktrucks to small feed mixers who do not have facilities

for receiving tankcar lots. These mixers, who are located within 150 to 200 miles of port terminals, can receive tanktruck shipments at a cost slightly above 1 cent more a gallon than if they were receiving tankcar shipments, but they save more than 6 cents a gallon over the cost of prebarreled purchases. Tanktruck distribution is currently important only in coastal areas in the northeastern United States, Florida, Texas, and California. Considerable savings could be made in the delivery of molasses by this method to small feed mixers in several other coastal areas and in many interior areas where small feed mills operate.

A great deal of expansion in molasses consumption could be obtained by following in other areas the distribution practices used in Florida, Texas, and on the West Coast for making liquid molasses available for direct farm feeding of beef cattle. A study of distribution of cane blackstrap and citrus molasses to feeders in Florida indicates that even relatively small farm units can be economically serviced by tanktrucks. Handling charges of 1.5 cents a gallon were made for lots as small as 1,000 gallons. This compared with charges in excess of 7 cents per gallon for molasses delivered in 55-gallon drums.

Producers of yeast, citric acid, and vinegar are users of approximately 50 million gallons of beet molasses and cane blackstrap annually. Yeast producers are by far the largest users of molasses in this group and have traditionally been the major market for mainland beet molasses production. However, higher transportation and handling costs than those from offshore production areas to mainland ports and citric acid processing plants have made this market as an outlet less attractive than formerly. Many beet companies are convinced that a higher net return can be realized from their molasses if feed markets in nearby areas can be developed.

MARKETING INDUSTRIAL MOLASSES

By B. K. Doyle, Agricultural Economist

INTRODUCTION

Need for the Study

The market for inedible molasses has been characterized by long periods of very low prices and large surpluses. Prices have risen to relatively high levels only in times of national emergency when unusually large quantities of molasses have been required as an industrial alcohol raw material.

The rapid expansion of production of low-cost synthetic ethyl alcohol and the displacement by it of ethyl alcohol produced from molasses have tended to depress prices of molasses in recent peacetime years. Since the only other large utilization field is in livestock feeds, the need for careful study of expansion of molasses consumption in this field offered many possibilities for effective research.

Some sections of the United States have made excellent progress in improving methods of marketing molasses so as to lower marketing costs and make supplies available to farmers and small feed mixers in small quantities at reasonable prices. Analysis of these improved practices and consideration of their adoption for use in other marketing areas offered opportunity for research that would point out possibilities for decreasing marketing costs and increasing molasses consumption. Accordingly, funds were made available under authority of the Research and Marketing Act of 1946 to carry out this study. It is believed that this report will provide useful information to molasses producers and consumers, marketing agents, and to Federal and State agencies.

Scope and Objectives

The analysis of the marketing of industrial molasses presented in this report is the second study 1/ by the Sugar Branch of the Production

1/ Kutish, L. John. The Marketing of Feed Molasses. Sugar Branch, Production and Marketing Administration, USDA. 32 pp., illus. Feb. 1950.

and Marketing Administration, concerning marketing practices, distribution costs, and possibilities of market expansion for this product. The general objective of these studies has been to determine how improvements can be brought about in the methods and practices used in marketing industrial molasses. A more efficient and less costly distribution system would result in increased utilization of this commodity which, undoubtedly, would serve to strengthen the producers' long-run position in the market.

This second study deals with the marketing methods and costs for the various types of industrial molasses and the factors affecting molasses utilization in the industrial alcohol and feed industries, and in the production of yeast, vinegar, and citric acid. The primary objectives of this study are: (1) To analyze the future place of molasses as a raw material in the production of ethyl alcohol, and the effect of the expected molasses utilization level in alcohol on molasses prices and utilization; (2) to recommend marketing methods that may lower marketing costs and improve marketing methods for molasses moving to the feed trade; and (3) to point out feed consumption areas in which molasses consumption might be more readily expanded. The more important points covered in a study of the place of molasses as a future ethyl alcohol raw material include methods and costs of distribution of molasses to alcohol plants, volume of use of molasses in industrial alcohol plants, production of ethyl alcohol from molasses and other raw materials, demand for and use of ethyl alcohol, and competition between the fermentation and synthetic alcohol industries. The phases of the study of marketing molasses, covered herein, that are most important to the feed trade include the marketing agencies involved in moving molasses from offshore or mainland areas of production to users of molasses for livestock feed; the marketing costs and margins for molasses moving from offshore areas to domestic feed mixers; the types of industrial molasses utilized by the feed-mixing trade in direct farm feeding and in grass silage and the reasons for choice of particular types; the quantities of molasses included in various types of livestock feeds and the factors affecting utilization levels; the marketing methods used for low-cost delivery of small lots of molasses and the possible adoption of these methods in regions not now using them. Also discussed are the type of molasses utilized by producers of yeast, citric acid, and vinegar and the methods and costs involved in moving molasses to these processors.

Sources of Information

Marketing agencies, including producers who also performed the marketing functions for their product, and consumers of industrial molasses were interviewed during the spring and early summer of 1950. Close contact has been maintained with all segments of the industry since that time. Those interviewed included: (1) Molasses distributors in New York, Louisiana, Florida, Alabama, and California; (2) molasses brokers in Florida, Louisiana, and Illinois; (3) feed company officials in Massachusetts, New York, Iowa, Michigan, Missouri, Illinois, Louisiana, and Florida (4) beet sugar company representatives in all areas of domestic beet production; (5) officials of yeast and citric acid companies; (6) producers and sellers of hydrol; and (7) producers and marketing agents of Florida citrus molasses. Besides the information gathered from these sources, information was obtained from several trade associations and from Government sources for use in this study.

Types of Molasses

Industrial molasses is a term applied to those types of molasses that are used primarily for purposes other than direct human consumption. The six types of industrial molasses to be considered are:

(1) Cane blackstrap molasses, a byproduct of the manufacture of raw sugar from sugarcane, usually containing slightly less than 55 percent total sugars, slightly more than 1 percent protein, and from 80 to 86 percent total solids.

(2) Refiners' blackstrap, a byproduct of the manufacture of white sugar from raw cane sugar, having approximately the same total sugars and chemical analysis as cane blackstrap molasses. 2/

2/ Raw cane sugar and blackstrap molasses are manufactured in mills located in the areas where sugarcane is grown. (These mills on occasion may produce high-test molasses, if a greater economic advantage exists for its production than for the production of raw sugar, particularly if sugar surpluses occur.) Some molasses adheres to the raw cane sugar that is later removed in the refining process. The refineries are usually separated geographically and commercially from the raw mills, and thus blackstrap production in the raw cane sugar stage and refiners' blackstrap production in the refined cane sugar stage are separate commercial processes.

(3) High-test (or invert) molasses, a product made from sugar-cane without the usual granulation and extraction of sugar, and containing from 72 to 75 percent total sugars, less than 2 percent protein, and 82 to 86 percent total solids.

(4) Beet molasses, a byproduct of the manufacture of beet sugar, containing from 48 to 52 percent total sugars, 6 to 10 percent protein, and 80 to 85 percent total solids. 3/

(5) Hydrol, a byproduct of the manufacture of refined corn sugar (dextrose), containing 60 to 64 percent total sugars, less than 1/2 of 1 percent protein, and about 75 percent total solids.

(6) Citrus molasses, a byproduct of citrus canning and concentrate processing made by concentrating waste waters, containing 41 to 43 percent total sugars, slightly less than 4 percent protein, and 70 to 73 percent total solids.

Later discussion will indicate the relative importance in industrial uses of these several types of molasses.

VARIATION OF MARKET SUPPLIES OF INDUSTRIAL MOLASSES 4/

The total supplies of molasses available to commerce on the United States mainland for 1935 to 1951 and the areas from which these supplies were obtained are shown in table 1. During this period molasses supplies were highly variable, fluctuating between 267 and 482 million gallons. These extremes occurred in 1946 and 1941 during the emergency

3/ Beet sugar is usually made in the same factories that process the sugar beets originally. Nearly all beet molasses originates in these factories, the only exception being cases in which "straight-house" beet molasses is transferred to other factories for further removal of sugar by the Steffens or ion exchange processes.

4/ Supply data are presented on a fiscal-year basis of 12 months ending June 30, unless otherwise specified, in order to compare supplies to use data. All data on utilization have been published on a fiscal-year basis.

period occasioned by World War II. However, in the 6-year period 1935 through 1940, total supplies varied from 332 to 453 million gallons. Molasses supplies have exceeded 400 million gallons annually during the last 4 years.

Because of the byproduct nature of molasses, the great variation in mainland supplies is due primarily to variations in the production of raw cane sugar, refined cane sugar, beet sugar, and refined corn sugar, and the quantity of citrus fruit processed rather than to variations in market demand. Small variations may also occur because of weather conditions and changes in processing methods. In the case of beet molasses, the quantity available for the market is determined by the amount of beet sugar produced and by the de-sugarization of straight-house (sometimes called "whole") beet molasses. The price relationship between beet sugar and beet molasses influences, to a great extent, the proportion of straight-house beet molasses sent through the de-sugarization processes.

The production of high-test molasses adds somewhat to the flexibility of the molasses supply. The value of the sugar content of molasses is usually low compared with the value of sugar as such sold for human consumption. However, surplus sugar is sometimes marketed in the form of high-sugar-content molasses. A relatively large volume of high-test molasses was produced from 1935 to 1940 because of low sugar prices coupled with large sugar carry-overs in those years. Production in more recent years was dictated by military considerations. ^{5/} Small quantities of high-test molasses are also produced when freezes occur in Louisiana and Florida and sucrose in sugarcane is inverted and recovery of sugar is not economical.

SOURCES OF MOLASSES SUPPLIES

Cuba consistently has been our largest supplier of industrial molasses. Table 2 shows the percentage of total mainland supplies furnished by Cuba and other areas. During the period 1937-1951, Cuban supplies were larger than total mainland production in all years except 1946, 1947, and 1951 and often filled more than half our requirements (table 1). Cuba ships blackstrap and refiners' blackstrap,

^{5/} Cuba produced the following amounts of high-test molasses in the indicated years: 1935--59 million gallons; 1936--116 million gallons; 1937--207 million gallons; 1938--89 million gallons; 1939--100 million gallons; 1940--178 million gallons; 1941--339 million gallons; 1942--169 million gallons; 1944--223 million gallons.

Table 1.--Total market supplies of industrial molasses available for use in the United States, 1935-51

| Year ended June 30 | Production in mainland areas | | | | | | Shipments from offshore domestic areas | | |
|-----------------------|------------------------------|-------------------|-------------------------|-------------------|-------------------|---------------------------|--|-------------------|------------------------------------|
| | Mainland cane 1/ | Domestic beet 2/ | Refiners' blackstrap 3/ | Citrus 4/ | Hydrol 5/ | Total mainland production | Hawaii 6/ | Puerto Rico 7/ | Total receipts from domestic areas |
| | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> |
| 1935 | 15,886 | 24,900 | 29,814 | - | 9,700 | 80,100 | - | - | - |
| 1936 | 23,380 | 25,400 | 28,863 | - | 8,500 | 85,943 | - | - | - |
| 1937 | 31,061 | 24,700 | 29,245 | - | 9,200 | 94,206 | 21,246 | 25,994 | 47,240 |
| 1938 | 33,531 | 26,400 | 25,619 | - | 8,000 | 93,550 | 35,251 | 28,892 | 64,143 |
| 1939 | 40,506 | 27,200 | 29,299 | - | 9,000 | 106,005 | 24,993 | 20,716 | 45,709 |
| 1940 | 31,716 | 24,800 | 27,972 | - | 10,000 | 94,488 | 28,389 | 20,562 | 48,951 |
| 1941 | 21,476 | 26,520 | 32,386 | - | 11,800 | 92,182 | 41,494 | 17,478 | 58,972 |
| 1942 | 26,052 | 21,763 | 28,398 | - | 15,400 | 91,613 | 38,625 | 23,433 | 62,058 |
| 1943 | 26,601 | 26,058 | 22,704 | - | 15,500 | 90,863 | 44,405 | 3,255 | 47,660 |
| 1944 | 33,184 | 23,415 | 32,744 | 2,554 | 14,200 | 106,097 | 43,850 | 19,049 | 62,899 |
| 1945 | 34,116 | 35,562 | 35,329 | 3,394 | 15,600 | 124,001 | 37,261 | 13,384 | 50,645 |
| 1946 | 32,165 | 40,861 | 25,389 | 7,783 | 11,700 | 117,898 | 38,041 | 19,696 | 57,737 |
| 1947 | 26,404 | 45,056 | 27,504 | 10,226 | 16,700 | 125,890 | 30,492 | 23,786 | 54,278 |
| 1948 | 27,076 | 35,886 | 33,677 | 11,609 | 14,000 | 122,248 | 43,796 | 41,133 | 84,929 |
| 1949 | 40,464 | 31,539 | 33,581 | 7,311 | 15,200 | 128,095 | 41,327 | 41,133 | 82,460 |
| 1950 | 37,722 | 42,610 | 33,433 | 7,285 | 16,400 | 137,450 | 43,299 | 44,656 | 87,955 |
| 1951 | 40,176 | 43,000 | 35,024 | 9,000 | 18,200 | 145,400 | 40,243 | 35,809 | 76,052 |

1/ 1935-47 from "World Sugar Situation", Bureau of Agricultural Economics, USDA, Sept. 1949; 1948-50 from unpublished data of Sugar Branch, PMA.

2/ 1935-40 estimated. 1940-50 are reports submitted by beet sugar companies to the Sugar Branch; 1950-51 is estimated.

3/ 1935-47 estimated by multiplying the refiners' production of sugar (short tons, raw value) by 6.25; 1948-51 from reports submitted to the Sugar Branch, PMA.

4/ Obtained from records of the Florida Citrus Processors Association; 1950-51 production estimated.

See following page for footnotes 5, 6, and 7.

Table 1.--Total market supplies of industrial molasses available for use in the United States, 1935-51--Continued

| Year ended June 30 | United States imports from foreign countries | | | | | | Total market supplies 1,000 gal. |
|--------------------|--|-----------------------|----------------------|-------------------|-------------------|-------------------|-------------------------------------|
| | Cuba 8/ | Dominican Republic 8/ | Dutch West Indies 8/ | Mexico 8/ | Other 8/9/ | Total imports 10/ | |
| | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | <u>1,000 gal.</u> | |
| 1935 | - | - | - | - | - | 312,500 | 392,600 |
| 1936 | - | - | - | - | - | 251,500 | 337,443 |
| 1937 | 246,757 | 22,712 | 11,265 | - | 31,236 | 311,970 | 453,416 |
| 1938 | 162,636 | 16,890 | 18,889 | - | 18,842 | 217,257 | 374,950 |
| 1939 | 133,864 | 22,105 | 5,845 | 1,340 | 17,037 | 180,191 | 331,905 |
| 1940 | 210,573 | 19,998 | - | 3,998 | 5,477 | 240,046 | 383,485 |
| 1941 | 279,889 | 37,043 | - | 6,973 | 7,453 | 331,358 | 482,512 |
| 1942 | 296,495 | 17,091 | - | 7,585 | 5,293 | 326,464 | 480,135 |
| 1943 | 135,133 | 1,463 | - | 4,597 | 2,779 | 143,972 | 282,495 |
| 1944 | 250,614 | 25,692 | - | 1,826 | 7,944 | 286,076 | 455,072 |
| 1945 | 170,189 | 28,968 | - | - | 5,961 | 205,118 | 379,764 |
| 1946 | 67,043 | 13,315 | - | 5,500 | 6,099 | 91,957 | 267,592 |
| 1947 | 65,339 | 23,033 | - | 16,048 | 7,607 | 112,027 | 292,195 |
| 1948 | 158,460 | 19,118 | - | 29,672 | 7,679 | 214,929 | 422,106 |
| 1949 | 160,202 | 17,287 | - | 28,616 | 12,234 | 218,339 | 428,714 |
| 1950 | 196,389 | 16,964 | - | 20,613 | 17,119 | 251,085 | 476,490 |
| 1951 | 116,234 | 10,450 | - | 26,057 | 42,462 | 195,204 | 416,656 |

5/ Estimated by multiplying total dextrose sales by a constant, assuming 2.09 gallons of hydrol per 100 pounds of dextrose.

6/ Data not available for 1935 and 1936. 1937-47 from published data Dept. of Commerce. 1948-50 data furnished by Hawaiian Sugar Planters Association.

7/ Data not available for 1935 and 1936.

8/ Summarized from Bureau of Customs data and reports from the Department of Commerce.

9/ Includes shipments from Canada, Poland, Peru, Java, Netherlands, Haiti, British West Indies, Trinidad, Italy, Denmark, Germany, France, British Guiana, and Nicaragua.

10/ In shipments from Puerto Rico and Hawaii included in total imports for 1935 and 1936.

although in some years large quantities of high-test molasses were shipped to the United States. Cuban shipments of blackstrap to this country averaged about 70 percent of her crop during the 10 years ended in 1944, but averaged 45 percent from 1946 through 1950 (table 2). During the last 2 years Cuban local consumption was 70 to 85 million gallons. The remainder of the Cuban production was sold to Great Britain and its possessions.

Mainland production of industrial molasses which ranks next to Cuba's production, has shown a steady upward trend and has tended to show considerable stability since 1944. From 1945 to 1951 mainland production of industrial molasses varied from about 122 to 145 million gallons. Approximately 100 million gallons was divided almost equally among cane blackstrap, refiners' blackstrap, and beet molasses. Hydrol and citrus molasses account for the remainder of mainland production. Louisiana and Florida supply all the cane blackstrap. Refiners' blackstrap is produced in Louisiana, Texas, Georgia, Maryland, Pennsylvania, New York, Massachusetts, and California. Beet molasses is produced in 82 factories located in 16 Midwestern and Western States from Michigan and Ohio to the West Coast. Citrus molasses is produced primarily in Florida, whereas hydrol is produced principally in Iowa, Illinois, Indiana, and Texas.

Puerto Rico and Hawaii are also important suppliers of molasses to the United States mainland. These offshore areas have contributed from about 55 to 90 million gallons to the mainland supply during the postwar period. Hawaiian supplies have been relatively stable since 1940 (approximately 10 million gallons annually), while Puerto Rican supplies fell off greatly during World War II and did not reach their present level of about 40 million gallons until 1948. Hawaii and Puerto Rico ship small quantities of refiners' blackstrap in addition to cane blackstrap.

Before and after World War II, mainland consumers purchased approximately 60 percent of the total Puerto Rican production. Puerto Rican shipments to the mainland accounted for 40 percent of the total production of that island from 1940 through 1944. Puerto Rico normally exports from 3 to 6 million gallons of molasses to Great Britain, consumes 6 to 12 million gallons locally, and sends the balance to the mainland. Continental users have received more than 85 percent of the cane blackstrap produced in Hawaii since 1939. Hawaii consumes only small quantities locally, does little exporting, and sends virtually all her crop to the West Coast.

Table 2.--Shipments of blackstrap molasses to the United States mainland expressed as a percentage of total annual production in Cuba, Puerto Rico, and Hawaii, 1935-50

| Year | Percentage of production shipped to the United States mainland | | | |
|------|--|------------------------|-------------------|----------------------|
| | Cuba Percent | Puerto Rico Percent | Hawaii Percent | All areas Percent |
| 1935 | 96.9 | 19.2 | 67.0 | 88.5 |
| 1936 | 75.7 | 62.2 | 45.7 | 69.9 |
| 1937 | 66.3 | 67.9 | 68.4 | 66.7 |
| 1938 | 56.0 | 41.4 | 58.3 | 54.3 |
| 1939 | 64.0 | 61.0 | 64.8 | 63.8 |
| 1940 | 78.8 | 59.4 | 70.2 | 75.7 |
| 1941 | 79.3 | 45.9 | 92.1 | 78.0 |
| 1942 | 58.4 | 23.5 | 78.4 | 56.4 |
| 1943 | 104.1 | 24.9 | 98.8 | 89.1 |
| 1944 | 55.0 | 62.5 | 82.6 | 57.8 |
| 1945 | 58.3 | 40.3 | 82.5 | 59.4 |
| 1946 | 24.8 | 45.0 | 89.2 | 34.9 |
| 1947 | 35.2 | 62.9 | 76.8 | 43.8 |
| 1948 | 41.9 | 81.8 | 102.2 | 53.1 |
| 1949 | 55.5 | 73.5 | 92.3 | 62.5 |
| 1950 | 71.2 | 63.1 | 99.3 | 77.9 |

Other sources that furnish supplies of significance are the Dominican Republic and Mexico. The Dominican Republic has shipped about 18 to 25 million gallons of cane blackstrap to the United States for many years. Mexico has been an important factor in the supply picture only since 1947 but now furnishes domestic users from 15 to 25 million gallons of cane blackstrap each year.

The importation of from 8 to 10 million gallons of beet molasses from Canada, Poland, Netherlands, Denmark, France, Germany, and Italy during 1949 and 1950, is an important item that is included in the over-all figures shown in table 1. These countries shipped about 27 million gallons to the United States in 1951.

MOLASSES PRICES

The customary method used in quoting molasses prices is on an f. o. b. tankcar basis in the originating port terminal. Freight is billed collect by the molasses distributor and it is the responsibility of the buyer or his agent to compute the delivered cost and to determine the most economical supply source.

There is no stable differential between molasses prices in the major terminal markets for mainland supplies; instead, the differential tends to widen with increases in molasses price levels. New Orleans prices tend to be somewhat lower than those quoted in New York and other east coast ports north of Hatteras. This differential has varied from 1/2 cent to more than 10 cents but usually it is between 1 and 3 cents. It was 1 cent when this survey was being made during the spring and early summer of 1950 and it was 5 cents in July 1951. Prices in Boston and Albany are 1/2 cent higher than in New York because of higher ocean freight rates. West coast molasses prices tend to be slightly less than east coast and gulf coast prices. The existence of a price differential between these distributing centers may be accounted for by differences in ocean freight, handling charges in domestic terminals, and the price relationship between molasses and grains in the areas in which molasses distributors make sales. Ocean freight from Cuba to the East Coast ports was approximately 1/2 cent a gallon higher than it was to Gulf Coast ports in mid-1950 and about 1 cent more in 1951, while handling costs in East Coast ports exceeded those in Gulf Coast ports by about 1/4 cent in the former period and 1/2 cent in the latter. Handling costs were higher because of the relatively poorer storage and handling facilities and higher fuel costs. Also, molasses was cheaper in relation to grain in the East Coast and northeastern areas because long shipments of grain by rail from producing areas result in

high transportation costs as compared with relatively inexpensive ocean shipments of molasses. New York and east coast molasses distributors sell the major share of their importations in the nearby dairy areas and to feed mixers located in the northeast area. New Orleans distributors sell a large part of their supplies to molasses consumers in the heavy grain-producing areas who pay high rail rates from New Orleans. Their bids are tempered somewhat because of the high transportation costs involved in molasses purchases. (For discussion of barge transportation see page 45.)

As pointed out previously, molasses prices have been highly variable in past years and the molasses market often has been in a distressed condition (fig. 1). Molasses producers, as well as consumers and marketing agencies, until recently, have not had a ready source of market information to enable them to appraise price movements or other marketing conditions. Heretofore, molasses price reporting has been infrequent or local in nature and much of the molasses trade has not had access to complete up-to-date market information. To meet the need for market news coverage, research was initiated by the United States Department of Agriculture in 1950 to determine the methods and procedures for obtaining reliable information on prices, stocks, and movements of molasses. A weekly market news report was begun early in 1951 on an experimental basis. The response from and the comments of the molasses trade regarding these reports indicate that this service is providing valuable and timely information to producers, distributors, and consumers of molasses.

In July 1951, the molasses market report was placed on a continuing regular market news basis. The weekly report includes cane blackstrap prices and market conditions at all major port terminals and for 6 major feed-mixing centers, beet molasses prices at 6 major consuming centers and in the major beet molasses-producing areas, and citrus molasses prices at 11 shipping points in Florida. Efforts are being made to expand market news coverage to include hydrol.

INDUSTRIAL MOLASSES USAGE

A brief over-all look at the data on molasses use and the changes occurring over a relatively long period will aid in interpreting the distribution and utilization discussions in subsequent sections of this report.

The most important uses of industrial molasses are in industrial alcohol and in livestock feeds. Other uses are in the production of yeast, citric acid, and vinegar, and to a small extent for food.

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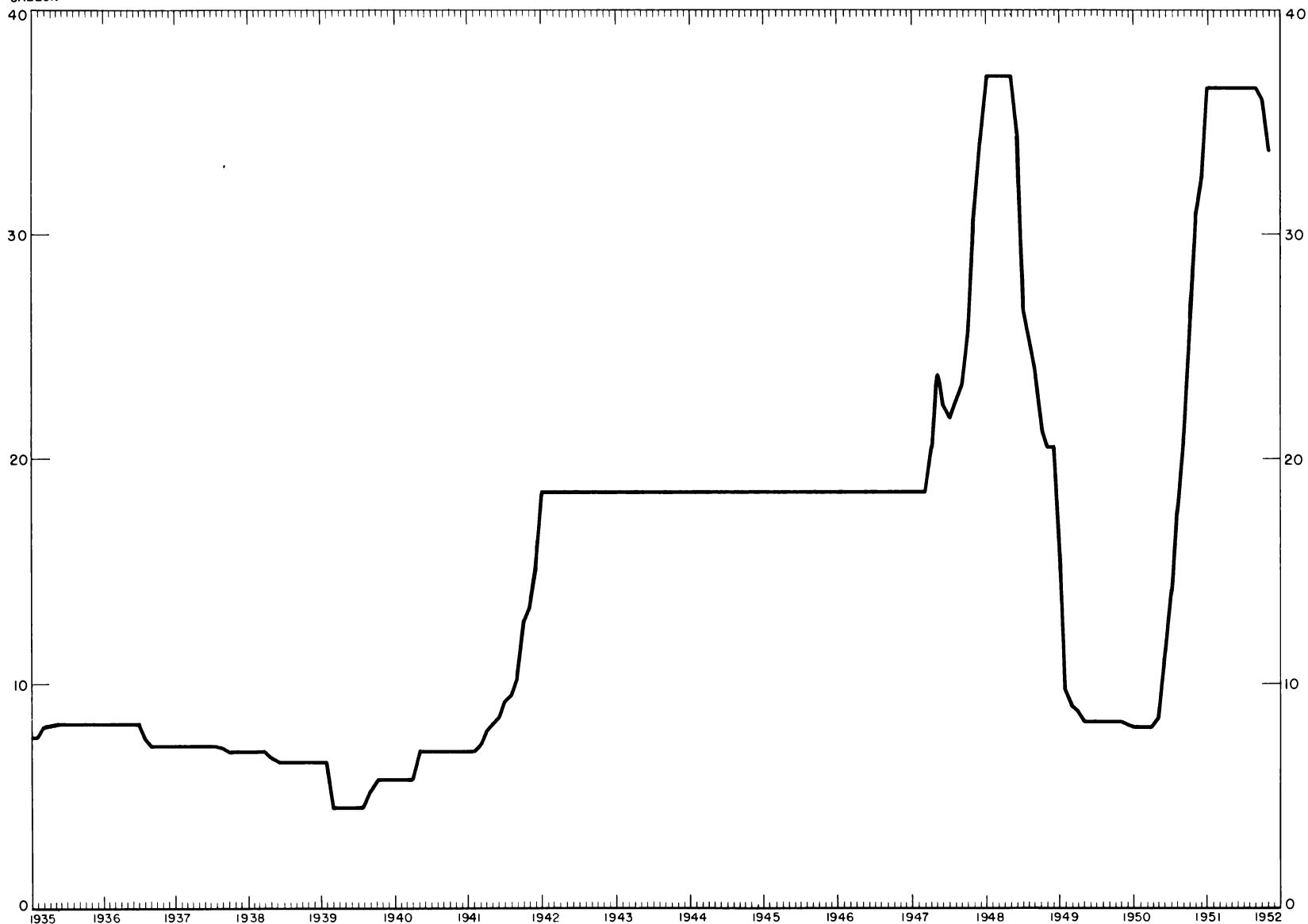


Figure 1--Molasses, blackstrap: Monthly price per gallon, f.o.b. in tank car, New York City, January 1935-November 1951. (Prices were controlled from January 1942-March 1947.)

Source: January 1935-December 1950, compiled by Bureau of Agricultural Economics from Oil, Paint, and Drug Reporter; January-November 1951, from Sugar Branch, PMA, Weekly Molasses Market Report.

The most significant changes in use that have occurred in recent years have been the decline in molasses utilization in the production of ethyl alcohol and the rapid increase in the utilization of molasses as feed (table 3). Approximately 177 million gallons of molasses were used as raw material for the production of ethyl alcohol in the 5 years 1935-39. Since 1945, the trend has been toward the displacement of molasses by petroleum products as raw material in the production of ethyl alcohol. Molasses utilization by the chemical industry in 1951 had dropped almost 50 million gallons below the 1935-39 level. On the other hand, the feed trade has almost doubled its consumption of molasses in the last decade, increasing it from an average of approximately 128 million gallons in 1935-39 to an estimated 267 million gallons, including citrus molasses and hydrol, in 1950. Because of short molasses supplies and very high prices, feed utilization of molasses dropped to 200 million gallons in 1951. Most of the decline occurred during the first 6 months of the calendar year 1951.

The use of molasses in the manufacture of yeast, citric acid, and vinegar, and as food has increased by about 15 percent since 1935-39. The total amount of molasses used for these purposes, however, is relatively small as compared with that for alcohol and feed.

From 1943 through 1946, the rate of molasses utilization for each purpose was established by a Government allocation program.

UTILIZATION OF MOLASSES IN INDUSTRIAL ALCOHOL

The following sections are presented primarily to provide information on the marketing methods and costs involved in moving molasses from offshore areas to domestic ethyl alcohol plants, the types of industrial molasses utilized in fermentation ethyl alcohol plants, and the trends in utilization of molasses in ethyl alcohol. Also discussed in detail is the future of molasses as an alcohol raw material and the effect this may have on molasses prices and utilization.

Methods and Costs of Distribution to Alcohol Plants

The physical distribution system used in moving molasses from supply areas to alcohol distilleries is a very direct and efficient one. Practically all molasses utilized in industrial alcohol plants originates in offshore areas and is shipped direct to processing plants in major port cities. Molasses is pumped from tankers, carrying approximately 1,800,000 to 2,000,000 gallons, into distillery storage tanks. A system of pumps and pipelines is used to transfer molasses from tank to tank and into the processing plants.

Table 3.--Estimated utilization of industrial molasses in the U. S. mainland, average 1935-39, annual 1943-51

| Industrial utilization in | Year beginning July | | | | | | | | | |
|--|---------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | 1935-39 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 |
| | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. | mil. gal. |
| Industrial alcohol plants | | | | | | | | | | |
| Ethyl alcohol | 177.1 | 171.4 | 249.6 | 224.7 | 103.4 | 70.3 | 175.9 | 156.7 | 129.1 | 128.5 |
| Other products <u>1/</u> | 20.7 | 12.5 | 54.5 | 43.0 | 30.3 | 27.9 | 19.8 | 13.7 | 20.4 | 25.0 |
| Total | 197.8 | 183.9 | 304.1 | 267.7 | 133.7 | 98.2 | 195.7 | 170.4 | 149.5 | 153.5 |
| Distilleries | | | | | | | | | | |
| Spirits and rum | 5.4 | 8.7 | 11.1 | 10.6 | 8.3 | 3.1 | 2.6 | 2.6 | 2.2 | 2.7 |
| Total in alcohol plants and distilleries <u>2/</u> | 203.2 | 192.6 | 315.2 | 278.3 | 142.0 | 101.3 | 198.3 | 173.0 | 151.7 | 156.2 |
| Livestock feed, direct feeding, and silage <u>3/</u> | 130.9 | 64.4 | 76.7 | 83.8 | 102.1 | 128.5 | 164.5 | 197.4 | 266.8 | 200.5 |
| Other uses | | | | | | | | | | |
| Yeast, citric acid and vinegar | 38.0 | 38.5 | 41.2 | 47.3 | 46.6 | 51.0 | 51.0 | 51.0 | 51.0 | 53.0 |
| Edible sirups and molasses etc. | 6.0 | 15.7 | 9.0 | 10.3 | 21.8 | 11.4 | 8.3 | 7.5 | 7.0 | 7.0 |
| Total other uses <u>4/</u> | 44.0 | 54.2 | 50.2 | 57.6 | 68.4 | 62.4 | 59.3 | 58.5 | 58.0 | 60.0 |
| Total utilization | 378.1 | 311.2 | 442.1 | 419.7 | 312.5 | 292.2 | 422.1 | 428.9 | 476.5 | 416.7 |

1/ Primary butyl alcohol and acetone.

2/ Data 1935-39 and 1947-51 are from the Alcohol Tax Unit, Bureau of Internal Revenue, and 1943-46 from U. S. Tariff Commission.

3/ Data from 1935-39 and 1947-51 are estimated by subtracting molasses used in alcohol plants and distilleries and an estimate of "other uses" from total mainland molasses supplies and using the residual as molasses utilized in feeds. No changes in stocks were considered. Information from 1943-46 from data issued by U. S. Tariff Commission.

4/ Data from 1935-39 and 1947-51 estimated by Sugar Branch and 1943-46 from U. S. Tariff Commission.

The major plants in this country for fermenting alcohol are in the ports of New Orleans and Philadelphia, and near Wilmington. Other plants are in New York City, Boston, and California. California producers receive molasses from Hawaii through the port areas of San Francisco and Long Beach. The Gulf coast and east coast distillers receive supplies from Cuba, Puerto Rico, Dominican Republic, and Mexico, with most of the Puerto Rican molasses moving to the east coast.

The general practice in the alcohol industry is to purchase molasses directly from sellers in offshore areas. Purchasing operations are carried on through subsidiary companies or by the purchasing departments of alcohol plants. It is only when the greater part of the offshore supplies has been purchased by feed molasses distributors in the United States that alcohol companies obtain supplies through intermediate marketing agents on the mainland. Alcohol companies usually purchase molasses from offshore distributors, who have assembled small quantities into cargo lots, or, in the case of Cuba, from the Cuban Sugar Stabilization Institute which is a single selling agency of the Cuban Government. Distillers attempt as early in the molasses production season as possible to contract for molasses supplies to be used during the coming 6 to 15 months, the length of time depending upon inventory positions of both molasses and alcohol and the price outlook for both the raw material and the finished product.

Fermentation alcohol producers, even those in Louisiana, buy very little mainland cane molasses, because the combined costs of freight and handling usually exceed the marketing costs incurred in obtaining supplies from Cuba and other offshore supply areas. Freight alone from sugar mills in Louisiana to New Orleans distilleries is approximately 1-3/4 cents a gallon. In addition, Louisiana and Florida supplies are scattered over a large area, individual mills produce relatively small quantities of molasses, and assembling as well as other marketing costs are high relative to those for imported supplies. Relatively high rail transportation costs, certain production problems, and the lack of a large centralized production explain why little or no citrus molasses, beet molasses, or hydrol is used in fermentation alcohol plants.

No formal grades or standards are used as a basis for molasses sales. The only specification considered is that of total sugar content of molasses. In all offshore areas, sales are made on the basis of 52 percent total sugars and premiums and discounts for sugar content are based on this standard. A postwar development in this distribution has

been the purchasing of molasses at a price quoted f. o. b. tanker in the originating port. The buyer is responsible for the ocean freight, duty, insurance, and handling charges involved in the unloading operation.

Marketing charges paid by alcohol producers vary with plant location, source of supply, and the situation as to availability of shipping space, all of which cause considerable fluctuation in freight rates from offshore areas. Estimated marketing costs per gallon of molasses bought f. o. b. tanker in Cuba and discharged in east coast plants in the first half of 1950 and 1951 were as follows:

| <u>Cost category</u> | <u>Cents per gallon</u> | |
|----------------------------------|-------------------------|-------------|
| | <u>1950</u> | <u>1951</u> |
| Ocean freight, north of Hatteras | 1. 50 | 4. 50 |
| Freight tax | . 10 | . 30 |
| Export tax | . 14 | . 54 |
| Duty, inspection, etc. | . 20 | . 25 |
| Shrinkage, 2 percent | . 14 | . 51 |
| Total | 2. 08 | 6. 10 |

Ocean freight was estimated on the basis of a two-port loading of tanker. Purchase prices used for computations were 5 cents a gallon f. o. b. tanker at Cuban ports in 1950, and 20 cents a gallon in 1951. Premiums for molasses containing more than 52 percent total sugars are not included as costs. All cost estimates were obtained in recent surveys. Because of the difference in ocean freight rates, and export and freight taxes, delivery costs from Puerto Rico to east coast distillers totaled 1. 70 cents in 1950 and 5. 50 cents in 1951, about 0. 40 cents a gallon less in 1950, and 0. 60 cents in 1951 than delivery cost of Cuban supplies. Dominican Republic supplies were moved to the east coast at about the same cost as Puerto Rican molasses. The increase in total cost between the first half of 1950 and 1951 is chiefly a result of increased freight rates. The reason for this large increase is primarily caused by the greater competition for available shipping space.

Marketing costs to Gulf coast distillers for molasses shipped from Cuba were 1. 60 cents a gallon because freight rates were about 0. 50 cents a gallon lower than for shipments to the East. Delivery of Puerto Rican and Dominican Republic supplies cost approximately the same for both east coast and Gulf coast alcohol producers. Hawaiian supplies moving to California were delivered at slightly higher cost than Cuban supplies to east coast and Gulf coast distillers.

Distillers have imported only blackstrap during the last few years, although during the periods of production of high-test molasses in Cuba, alcohol producers were the major importers of this type of molasses. This might be expected since the alcohol industry is interested primarily in total fermentable sugars. A larger quantity of alcohol can be produced from a given quantity of high-test molasses than from the same quantity of blackstrap molasses. Thus, marketing costs are reduced if high-test molasses is used because smaller shipments are sufficient to meet molasses needs in alcohol production. Certain production efficiencies also result that make the utilization of high-test molasses economical.

Volume of Molasses Usage in Industrial Alcohol Plants 6/

Until 1947 the most important use of molasses was as raw material in industrial alcohol production. Since that time, utilization of industrial molasses in the feed industry has been greater than the quantities processed in alcohol plants in 4 of 5 years. During the 6 years prior to 1941, an average of approximately 180 million gallons of molasses was used in the production of ethyl alcohol. In addition, about 30 million gallons of molasses was used in other products of industrial alcohol plants, primarily acetone and butyl alcohol, and distilled spirits (table 4). Utilization of molasses in making alcohol, and of all other raw materials for the production of alcohol, was greatly increased during the rearmament and war period 1941-45. An average of almost 235 million gallons of molasses annually was processed into ethyl alcohol during these 5 years.

The use of molasses in the production of ethyl alcohol declined rapidly during the next 2 years, recovered to prewar levels in 1947-48, but by 1951 had fallen to 128 million gallons. The production of other products of industrial alcohol plants, as well as distilled spirits, likewise was expanded during the war but decreased in postwar years.

Relative Importance of Molasses and Other Raw Materials in Ethyl Alcohol Production

When the postwar period is compared with prewar years, it is evident that molasses has become less important than formerly as a factor in the production of ethyl alcohol. Although ethyl alcohol produced

6/ Data in this and the following sections concerned with production and utilization of ethyl alcohol are on a fiscal-year basis of 12 months ending June 30, unless otherwise specified.

Table 4.--Industrial molasses used in the production of ethyl alcohol and other products of industrial alcohol plants and distilled spirits in distilleries, 1935-51

| Year ended June 30 | Industrial molasses used in the production of-- | | | Total usage of industrial molasses in industrial alcohol plants and distilleries |
|--------------------|---|---|-----------------------------|--|
| | Ethyl alcohol <u>1/</u> | Other products of industrial alcohol plants <u>2/</u> | Distilled spirits <u>3/</u> | |
| | <u>Gallons</u> | <u>Gallons</u> | <u>Gallons</u> | <u>Gallons</u> |
| '1935 | 187,849,299 | 11,378,631 | 7,416,832 | 206,644,762 |
| 1936 | 173,385,873 | 13,075,949 | 5,737,208 | 192,199,030 |
| 1937 | 202,631,056 | 32,472,450 | 5,439,680 | 240,543,166 |
| 1938 | 162,557,843 | 27,987,171 | 4,164,633 | 194,709,647 |
| 1939 | 158,908,347 | 18,841,142 | 4,314,729 | 182,064,218 |
| 1940 | 194,601,378 | 43,544,144 | 4,328,001 | 242,473,523 |
| 1941 | 221,820,392 | 59,602,277 | 3,528,327 | 284,950,996 |
| 1942 | 281,082,026 | 51,494,017 | 5,091,586 | 337,667,629 |
| 1943 | 174,368,827 | 15,020,815 | 8,670,107 | 198,059,749 |
| 1944 | 252,802,147 | 56,800,846 | 11,086,788 | 320,689,781 |
| 1945 | 232,175,077 | 46,281,165 | 10,610,766 | 289,067,008 |
| 1946 | 109,258,237 | 30,272,711 | 8,261,498 | 147,792,446 |
| 1947 | 70,310,252 | 27,945,575 | 3,072,209 | 101,328,036 |
| 1948 | 175,947,462 | 19,768,298 | 2,554,650 | 198,270,410 |
| 1949 | 156,731,884 | 13,652,330 | 2,622,888 | 173,007,102 |
| 1950 | 129,110,565 | 20,411,727 | 2,217,661 | 151,739,953 |
| 1951 | 128,536,707 | ^{4/} 25,000,000 | 2,669,334 | 156,206,041 |

^{1/} Includes "molasses mixtures" used in making ethyl alcohol.

^{2/} Chiefly butyl alcohol and acetone.

^{3/} Chiefly rum and gin.

^{4/} Estimated by the Sugar Branch.

Source: Annual Report of the Commissioner of Internal Revenue, U. S. Treasury Department, and Monthly Reports of the Alcohol Tax Unit, Bureau of Internal Revenue.

from molasses accounted for an average of more than 70 percent of total production during the 9 years prior to 1943, an average of only slightly more than 30 percent of the ethyl alcohol produced in the United States came from molasses during the 6-year period 1945 through 1951. The quantity of ethyl alcohol produced from molasses was smaller in the more recent period even though total ethyl alcohol production increased by approximately one-third (table 5).

Of major significance has been the steady trend in the quantity of ethyl alcohol produced from ethyl sulphate and ethylene gas, the petroleum products from which most synthetic ethyl alcohol is produced. Production of ethyl alcohol from petroleum products increased from approximately 9 million wine gallons in 1935 to 104 million in 1950 and an estimated 115 million in 1951. Synthetic ethyl alcohol averaged only 19 percent of the total during the first 8 years under study, but during the 5 years starting with 1947 accounted for an average of approximately 50 percent of total industrial ethyl alcohol production. In 1950 almost 65 percent of all industrial ethyl alcohol produced came from ethyl sulphate and ethylene gas, whereas, in 1951, an estimated 50 percent came from petroleum products.

Grain was important as a raw material for ethyl alcohol only during and for a short period following the war emergency period. This relatively high-cost material was utilized primarily because sufficient supplies of other raw materials were unavailable. During the peak of wartime demands for ethyl alcohol, approximately 35 percent of the alcohol produced came from grain. By 1950 grain alcohol accounted for less than 1 percent of the total. However, by the last quarter of the calendar year 1950 and the first quarter of 1951, large quantities of grain were being utilized. Molasses supplies were very short; and wet, distress grain sorghum was available at prices close to molasses raw material costs, so that 25 percent of the total domestic production of ethyl alcohol came from grain in 1951.

Ethyl Alcohol Withdrawals and Stocks

The demand for ethyl alcohol has increased noticeably during the last 15 years, even when wartime requirements are omitted. Withdrawals from storage, shown in table 6, are the best indication of this trend. Utilization of ethyl alcohol is very sensitive to general industrial activity since the commodity is used primarily in the production of industrial and consumer goods. This undoubtedly will be one of the major determining factors in the future demand level for ethyl alcohol.

Table 5.--Quantity of ethyl alcohol produced from specified raw materials, 1935-51

| Year ended June 30 - | From Molasses 1/ | | From ethyl sulfate | | From grain 2/ | | From all other materials 3/ | | Total net ethyl alcohol production from all sources 4/ | |
|----------------------|------------------|---------|--------------------|---------|---------------|-------|-----------------------------|-------|--|--------|
| | Wine gal. | Pct. | Wine gal. | Pct. | Wine gal. | Pct. | Wine gal. | Pct. | Wine gal. | Pct. |
| 1935 | 81,283,647 | 85.49 | 9,254,836 | 9.73 | 2,600,514 | 2.74 | 1,937,804 | 2.04 | 95,076,801 | 100.00 |
| 1936 | 78,609,660 | 76.15 | 16,573,258 | 16.09 | 7,270,723 | 7.04 | 770,696 | .72 | 103,224,337 | 100.00 |
| 1937 | 88,954,368 | 75.73 | 17,836,360 | 15.18 | 9,816,814 | 8.36 | 856,265 | .73 | 117,463,807 | 100.00 |
| 1938 | 77,383,398 | 73.13 | 18,616,922 | 17.59 | 9,645,318 | 9.12 | 161,657 | .16 | 105,807,295 | 100.00 |
| 1939 | 71,491,731 | 67.57 | 25,243,955 | 23.86 | 8,178,930 | 7.73 | 884,094 | .84 | 105,798,710 | 100.00 |
| 1940 | 87,951,759 | 68.56 | 32,215,848 | 25.12 | 7,356,025 | 5.73 | 754,137 | .59 | 128,277,769 | 100.00 |
| 1941 | 110,750,952 | 70.41 | 36,790,948 | 23.39 | 9,227,601 | 5.87 | 517,564 | .33 | 157,287,065 | 100.00 |
| 1942 | 152,313,584 | 68.98 | 47,692,241 | 21.60 | 20,304,410 | 9.19 | 514,294 | .23 | 220,824,529 | 100.00 |
| 1943 | 83,784,007 | 43.65 | 50,915,269 | 26.53 | 56,766,754 | 29.57 | 480,804 | .25 | 191,946,834 | 100.00 |
| 1944 | 109,222,541 | 35.12 | 59,859,750 | 19.25 | 108,554,233 | 34.90 | 33,378,769 | 10.73 | 311,015,293 | 100.00 |
| 1945 | 100,105,881 | 29.26 | 58,778,288 | 17.18 | 148,260,547 | 43.33 | 35,007,856 | 10.23 | 342,152,572 | 100.00 |
| 1946 | 45,851,801 | 26.45 | 67,109,240 | 38.71 | 55,243,615 | 31.86 | 5,156,906 | 2.98 | 173,361,562 | 100.00 |
| 1947 | 28,504,588 | 21.77 | 70,160,794 | 53.58 | 20,917,073 | 15.97 | 11,364,199 | 8.68 | 130,946,654 | 100.00 |
| 1948 | 74,909,698 | 42.83 | 73,804,253 | 42.21 | 18,240,943 | 10.43 | 8,173,616 | 4.53 | 175,128,510 | 100.00 |
| 1949 | 67,047,454 | 36.29 | 86,720,595 | 46.94 | 6,037,813 | 3.27 | 24,939,569 | 13.50 | 184,744,931 | 100.00 |
| 1950 | 56,873,033 | 5/34.46 | 89,671,725 | 5/54.34 | 1,341,493 | .815/ | 17,135,192 | 10.39 | 165,021,443 | 100.00 |
| 1951 | 55,973,563 | 23.90 | 97,072,987 | 41.45 | 60,320,420 | 25.76 | 20,809,351 | 8.89 | 234,176,321 | 100.00 |

1/ Additional amounts of alcohol were made from "molasses mixtures"; such alcohol is included in the column, "From all other materials."

2/ Additional amounts of alcohol were made from "grain mixtures"; such alcohol is included in the column, "From all other materials."

3/ Chiefly ethylene gas, sulfite liquors, cellulose pulp, chemical and crude alcohol mixtures, whey, pineapple juice, grain and molasses mixtures, and potatoes and potato products. Potatoes were important when they produced, in 1946 - 1,985,102 wine gallons of ethyl alcohol, in 1947 - 6,769,117 wine gallons, in 1948 - 2,560,402 wine gallons, and in 1949 - 11,331,637 wine gallons.

4/ Gross production of ethyl alcohol minus the number of wine gallons of unfinished products used in redistillation. This factor was not an important element until 1942.

5/ Includes 14,259,167 wine gallons from ethylene gas in 1950 and 16,438,967 in 1951.

Source: "Statistics on Alcohol," Alcohol Tax Unit, Bureau of Internal Revenue.

Table 6.--Ethyl alcohol: Withdrawals and losses, production, and stocks on hand at end of year, 1935-51

| Year ended June 30 - | Withdrawals | | | | Losses 4/ Wine gal. | Total withdrawals plus losses 2/ Production | | Stocks June 30 Wine gal. |
|----------------------|--------------------------|--|---|-------------------------------|------------------------|--|-------------|-----------------------------|
| | Tax-paid 1/ Wine gal. | Used for denatura- tion 2/ Wine gal. | For use of the United States 3/ Wine gal. | Other uses 3/ Wine gal. | | Wine gal. | Wine gal. | |
| | | | | | | | | |
| 1935 | 8,942,614 | 85,794,610 | 448,745 | 1,180,203 | 292,246 | 96,658,418 | 95,076,784 | 13,290,922 |
| 1936 | 12,659,225 | 90,778,272 | 523,018 | 1,270,413 | 230,974 | 105,461,902 | 103,224,317 | 11,210,703 |
| 1937 | 16,994,550 | 94,381,233 | 548,330 | 1,349,985 | 277,997 | 113,552,095 | 117,463,784 | 14,981,335 |
| 1938 | 15,250,844 | 86,454,306 | 500,400 | 1,414,781 | 276,252 | 103,896,533 | 105,807,276 | 16,866,646 |
| 1939 | 11,658,403 | 92,444,532 | 556,890 | 1,514,829 | 261,098 | 106,535,552 | 105,798,690 | 16,242,287 |
| 1940 | 12,812,790 | 117,537,719 | 644,476 | 1,542,218 | 261,207 | 132,798,410 | 128,277,745 | 11,472,921 |
| 1941 | 14,666,589 | 144,677,481 | 1,945,267 | 1,608,053 | 366,916 | 163,264,306 | 157,287,035 | 5,469,658 |
| 1942 | 13,122,282 | 197,242,208 | 22,799,641 | 1,612,611 | 433,818 | 235,210,560 | 220,824,487 | 15,270,663 |
| 1943 | 2,987,021 | 214,896,689 | 54,276,196 | 1,115,309 | 1,056,528 | 274,341,743 | 191,946,797 | 112,064,853 |
| 1944 | 3,251,946 | 512,336,521 | 64,419,908 | 1,231,806 | 888,696 | 582,128,877 | 311,015,234 | 67,326,076 |
| 1945 | 14,650,826 | 511,287,760 | 58,531,632 | 1,160,599 | 725,591 | 586,356,408 | 342,152,507 | 75,599,510 |
| 1946 | 24,875,343 | 207,083,385 | 6,711,245 | 1,379,022 | 596,476 | 240,645,471 | 173,361,529 | 58,178,404 |
| 1947 | 24,812,662 | 177,910,490 | 1,547,320 | 1,374,409 | 550,769 | 206,195,650 | 130,946,630 | 14,219,068 |
| 1948 | 20,399,153 | 178,764,046 | 149,709 | 1,810,407 | 472,517 | 201,595,832 | 174,885,311 | 20,143,869 |
| 1949 | 21,497,741 | 170,487,303 | 339,415 | 1,420,010 | 536,197 | 194,280,666 | 184,744,897 | 26,850,196 |
| 1950 | 21,349,931 | 169,321,932 | 305,910 | 2,230,184 | 526,316 | 193,734,273 | 165,021,443 | 12,225,645 |
| 1951 | 22,529,573 | 178,414,394 | 18,538,477 | 1,325,004 | 5/600,000 | 221,407,488 | 234,176,320 | 6/52,464,964 |

1/ For beverage use.

2/ Represents withdrawals for denaturation 1934 through 1941. For 1942 through 1947 represents all products used for denaturation which were regarded, upon receipt at denaturation plants, as alcohol, whether originally produced as alcohol by industrial alcohol plants or as spirits or unfinished spirits by registered distilleries. This explains why the withdrawal data are so much larger than the production figures during the middle 1940's.

3/ Represents withdrawals for hospital, scientific, and educational use, for export, and in Puerto Rico for medicinal, beverage, and industrial use.

4/ Losses in industrial alcohol bonded warehouses, exclusive of losses in denaturing plants.

5/ Estimated by Sugar Branch, FMA.

6/ Not including stocks of imported alcohol of 10,043,185 wine gallons on June 30, 1951.

Source: "Statistics on Alcohol," Alcohol Tax Unit, Bureau of Internal Revenue.

As one might expect, withdrawals correspond closely to ethyl alcohol production prior to 1942. From 1942 to 1947, however, available statistics make these comparisons difficult since much of the alcohol included as withdrawals was not produced in industrial alcohol plants but in registered beverage alcohol distilleries. During part of this period, 1946 and 1947, heavy wartime stocks were liquidated and ethyl alcohol production dropped to 1940 levels although withdrawals were 50 percent higher. During the last 4 years withdrawals and production have been comparable and considerably higher than in prewar years.

The decline in alcohol production after the end of hostilities was reflected in the utilization of less molasses in alcohol plants. Since production of synthetic alcohol increased during this period, the cut-back in production was absorbed almost entirely by the molasses and grain distillers.

Stocks of ethyl alcohol of 12 million wine gallons on June 30, 1950, were the lowest since 1941 and were particularly low in comparison with withdrawal levels. However, stock positions of alcohol were bolstered considerably by sizable importations of alcohol, and stocks were slightly above 60 million on June 30, 1951. This was the highest stock level since 1945. Ethyl alcohol stocks were maintained near this high level in the fall of 1951 even with the operation of a defense synthetic rubber program requiring in excess of 100 million wine gallons annually. Sizable imports of alcohol have continued and domestic distillers have made use of unusually large quantities of grain sorghums and corn as raw materials for ethyl alcohol. These supply factors made it possible for the Reconstruction Finance Corporation, the Government agency charged with purchasing alcohol for the synthetic rubber program, to announce in early November 1951 that it had on hand and under commitment more than 100 million gallons of ethyl alcohol. This supply is believed to be sufficient for several months in 1952.

Production and Use of Denatured Alcohol

All industrial ethyl alcohol is denatured to render it unfit for human consumption and free from Federal beverage alcohol taxes. Available statistics show only production of specially and completely denatured alcohol and not the various denaturing formulas used (table 7). Completely denatured alcohol production has fallen rapidly during the last 2 years, chiefly because of the competition of synthetic alcohol chemicals, such as methanol, in its major use, antifreeze solution. The 1950 and 1951 production of completely denatured alcohol represents a decline of more than 20 million wine gallons from the 1935-41 average.

Table 7.--Production of denatured alcohol, 1935-51

| Fiscal year ended June 30 | Specially denatured | Completely denatured | Total |
|---------------------------------|------------------------|-------------------------|---------------------|
| | <u>Wine gallons</u> | <u>Wine gallons</u> | <u>Wine gallons</u> |
| 1935 | 58,284,395 | 38,746,679 | 97,031,074 |
| 1936 | 64,955,485 | 36,522,358 | 101,477,843 |
| 1937 | 80,084,281 | 22,118,378 | 102,202,659 |
| 1938 | 69,009,024 | 25,598,717 | 94,607,741 |
| 1939 | 83,561,077 | 17,179,433 | 100,740,510 |
| 1940 | 111,409,797 | 15,352,033 | 126,761,830 |
| 1941 | 135,834,261 | 17,676,172 | 153,510,433 |
| 1942 | 179,217,153 | 28,628,181 | 207,845,334 |
| 1943 | 198,524,631 | 24,369,788 | 222,894,419 |
| 1944 | 471,781,825 | 52,331,761 | 524,113,586 |
| 1945 | 494,008,004 | 33,087,533 | 527,095,537 |
| 1946 | 186,657,673 | 26,144,437 | 212,802,110 |
| 1947 | 147,348,371 | 36,395,715 | 183,744,086 |
| 1948 | 149,394,037 | 34,887,789 | 184,281,826 |
| 1949 | 164,273,211 | 10,221,492 | 174,494,703 |
| 1950 | 170,259,583 | 4,414,058 | 174,673,641 |
| 1951 | 243,998,613 | 1,438,564 | 245,437,177 |

Source: "Statistics on Alcohol," Alcohol Tax Unit, Bureau of Internal Revenue.

Since virtually all industrial ethyl alcohol at the present time is specially denatured, the statistics on the use of the specially denatured product indicate the major end uses for industrial alcohol (table 8). Over the period under study, the significant change has been the trend upward in the utilization of specially denatured alcohol in the production of aldehydes.^{7/} Historically, solvents have been the backbone of the alcohol market, but in 1950 use of specially denatured alcohol in aldehydes was more than three times its prewar volume, and exceeded ethyl alcohol use in solvents by more than 60 percent. By far the greatest use of specially denatured alcohol during the war was for the emergency synthetic rubber program. The manufacture of this product from industrial alcohol was relatively unimportant during the postwar years but is at present a very strong factor in the alcohol market because of the demand for rubber supplies created by the present emergency. The volume of specially denatured alcohol utilized in the manufacture of other chemical products increased moderately during the war, then leveled out in the postwar period at a volume slightly under prewar. Total utilization of specially denatured alcohol in 1950 was about 40 percent above the 1940 volume.

Fermentation-synthetic Alcohol Competition

The probable future demand and the long-run price level for blackstrap molasses must be considered in relation to the competition of synthetic alcohol with fermentation alcohol. This section points out factors affecting the marketing of alcohol and products manufactured from alcohol, as well as some of the important factors influencing the production of synthetic and fermentation alcohol. Also considered is the sharing of the total alcohol market between ethyl alcohol and other types of alcohol.

The fermentation alcohol industry has advantages and disadvantages in relation to the synthetic alcohol industry, and they affect the relative sharing of the chemical market by the two industries. The most important advantage of the synthetic alcohol industry over the fermentation industry is its ability to enter into long-term contracts with industrial users of ethyl alcohol. These contracts can be made because the synthetic industry has an assured raw material supply source. Synthetic plants are either

^{7/} Aldehydes are converted to other special chemicals, such as acetic acid and acetic anhydride. A large part of the expansion has come from use of acetic anhydride in the rayon textile industry.

Table 8.--Uses of specially denatured alcohol, 1935-50

| Year ended June 30 | Used as a solvent 1/ | Aldehydes | Used as a raw material converted in chemical manufacturing | | Uses other than solvent and chemical manufacturing 3/ | Total utilization |
|--------------------|----------------------|---------------------|--|----------------------------|---|---------------------|
| | | | Synthetic rubber | Other chemical products 2/ | | |
| | <u>Wine gallons</u> | <u>Wine gallons</u> | <u>Wine gallons</u> | <u>Wine gallons</u> | <u>Wine gallons</u> | <u>Wine gallons</u> |
| 1935 4/ | - | - | - | - | - | - |
| 1936 5/ | 63,407,973 | 16,650,777 | - | 28,607,288 | 467,803 | 109,133,841 |
| 1937 5/ | 79,018,340 | 27,160,082 | - | 32,458,847 | 471,826 | 139,109,095 |
| 1938 4/ | - | - | - | - | - | - |
| 1939 4/ | - | - | - | - | - | - |
| 1940 6/ | 46,238,101 | 24,572,238 | - | 33,209,336 | 4,344,958 | 108,364,633 |
| 1941 | 59,841,740 | 30,338,549 | - | 40,322,793 | 4,021,979 | 134,525,061 |
| 1942 | 86,390,613 | 34,402,948 | - | 40,354,169 | 8,089,670 | 169,237,400 |
| 1943 | 72,987,392 | 44,732,885 | 20,399,165 | 41,379,684 | 2,208,836 | 181,707,962 |
| 1944 | 66,310,074 | 59,730,282 | 286,033,171 | 52,202,416 | 1,717,107 | 465,993,050 |
| 1945 | 68,030,703 | 55,733,932 | 315,940,167 | 53,524,181 | 2,438,024 | 495,993,050 |
| 1946 | 50,897,999 | 54,018,723 | 62,671,789 | 27,800,474 | 994,335 | 196,383,320 |
| 1947 | 53,257,426 | 65,550,902 | 9,259,489 | 28,026,693 | 995,699 | 157,090,209 |
| 1948 | 47,016,052 | 72,932,439 | 370,818 | 28,493,876 | 1,029,532 | 149,842,717 |
| 1949 | 46,444,874 | 68,253,434 | 1,427,787 | 32,017,886 | 855,518 | 148,999,499 |
| 1950 | 51,284,605 | 87,155,696 | 3,872,867 | 35,797,068 | 975,401 | 179,085,637 |

1/ Specially denatured alcohol used as a solvent is utilized principally in connection with the following products or uses: (a) lacquers, varnishes, and enamels; (b) plastics; (c) solvents and thinners for cellulose, shellac, and resin products; (d) lotions, perfumes, and other toilet preparations; (e) the processing of industrial, food, drug, and other products, for instance, the dehydration of nitrocellulose; (f) pharmaceutical products, such as rubbing alcohol; (g) cleaning, preserving, and flavoring preparations.

2/ When used as a raw material, the denatured alcohol reacts in the formation of other chemicals. Principal products using denatured alcohol as a raw material are: Vinegar, ethyl acetate, ethyl chloride, esters, ethers, ethylene dibromide, etc.

3/ This category includes: Brake fluids, cutting oils, other fluid uses, motor fuels and fuel uses, and experimental uses.

4/ No data available. No reports issued.

5/ Total quantities used, including large quantities previously recovered for re-use.

6/ Beginning with 1940, the figures relate only to new denatured alcohol, and exclude previously recovered alcohol which was re-used.

Source: Alcohol Tax Unit, Bureau of Internal Revenue, Treasury Department.

subsidiary units of the petroleum refining industry or have long-term raw material supply contracts, estimated to run up to 10 years, with petroleum producers. In addition to an assured supply for a good part of total capacity, synthetic producers have two important raw materials available. These are cracked refinery gases and propane. Propane is by far the most important of these materials. Costs are difficult to compute for cracked refinery gases since they may or may not be a waste material; some refineries have other uses for at least a part of these gases.

Fermentation alcohol producers do not have this assured source of molasses supplies. With the rapidly increasing competition from molasses buyers for the feed trade, the ability of distillers to obtain large quantities of molasses year after year at very low prices has virtually disappeared. Feed molasses distributors have become the major buyers of molasses even in Cuba and the price of alcohol is not the dominating factor in setting molasses prices that it once was. The resulting variation in molasses supplies and the ability of distillers to obtain molasses at prices that will allow competition with synthetic alcohol producers has made large-scale contracts with industrial alcohol users difficult.

Future over-all production of ethyl alcohol will also be important in determining the quantity of molasses used in the fermentation alcohol industry. Although the level of chemical industry activity has been very high since the war and many new uses have been found for alcohol, ethyl alcohol production has not expanded as rapidly as the growth in alcohol utilization. Utilization of ethyl alcohol has met stiff competition in many of its uses from methyl and isopropyl alcohol. These types of alcohol are produced almost entirely from petroleum products by synthetic ethyl alcohol producers. Isopropyl and methyl alcohols have supplanted ethyl alcohol for a large part of the anti-freeze business. Acetic acid, formerly made from ethyl alcohol, is now in part produced from isopropyl alcohol. These types of industrial alcohol, primarily isopropyl, also compete with ethyl alcohol for numerous extractive and solvent uses and have been largely responsible for the lack of expansion of use of ethyl alcohol in solvents. Another recent development in which ethyl alcohol is the chief raw material, has been the oxidation of hydrocarbon gases to acetaldehyde. This may in the future offer competition in the major peacetime end use of ethyl alcohol.

The expansion in the production of methyl and isopropyl alcohol by synthetic alcohol producers has been very rapid. The production of methyl alcohol has tripled since 1945, from approximately 50 million

gallons to about 135 million gallons in 1950. Isopropyl alcohol production is about three times as great as in 1941. Production has increased from about 35 million gallons to slightly more than 100 million.

In view of the data presented earlier, it may be concluded that, under peacetime conditions, the fermentation alcohol market cannot be counted on to absorb the quantities of molasses in the years to come that were channeled to the alcohol industry in prewar periods.

UTILIZATION OF INDUSTRIAL MOLASSES IN YEAST, CITRIC ACID, AND VINEGAR

Types of Industrial Molasses Utilized

Producers of yeast, citric acid, and vinegar use annually approximately 50 million gallons of beet molasses and cane blackstrap. Yeast producers are by far the largest users of molasses in this group of consumers. Citric acid and vinegar producers are about equal in importance as consumers of molasses. This group of consumers, especially the yeast and citric acid firms, use more than 60 percent, or about 20 million gallons a year, of domestically produced beet molasses. The remaining requirements are met by the use of cane blackstrap and imported beet molasses.

In making yeast, both cane blackstrap and beet molasses are used as a blend. Most yeast producers prefer a higher percentage of beet than of cane blackstrap. Beet molasses has a higher protein content and is less expensive to clarify. Because of these advantages, yeast producers have been willing to pay from 1 to 2 cents a gallon, or from \$2 to \$3 a ton, more for beet molasses than for cane blackstrap. On the other hand, there is often less trouble from acidity or sulphur dioxide in cane blackstrap than in beet molasses. A blend of the two types of molasses is used to obtain permissible sulphur dioxide and acidity content for yeast production and to make use of certain different properties of the two types of molasses that affect the end product.

Considerable research has been done for several years with the objective of increasing the cane blackstrap portion of the blend. This has generally been successful, and additional necessary equipment, particularly filtering equipment, has been added in several yeast plants located near or in water terminals and in areas where freight rates from port terminals or from the Louisiana producing area are economical as compared with rates from beet-producing areas. As these processing and shipping developments gain impetus, the margin between

the delivered prices of beet molasses and cane blackstrap will tend to narrow and possibly disappear so that such prices will be the same on a delivered basis.

Citric acid is made either from beet molasses alone or from a blend of beet molasses and cane blackstrap. The preference of the industry, however, seems to be for all beet molasses or for a blend containing mostly this type of molasses. Certain processing advantages, primarily higher yields of citric acid and lower yields of oxalic acid, accrue from the use of beet molasses.

Vinegar is customarily made from cane blackstrap, primarily because this type of molasses usually is cheaper delivered to processing plants than beet molasses.

Marketing Agencies Involved and Sources of Supply

Yeast plants are located in three general areas of the United States, and distribution practices, source of molasses supplies, and the number and type of marketing agencies involved differ with the location of plant. Processing plants are located along the eastern seaboard from Washington, D. C., north to New York, in the Midwest along the Mississippi River from St. Louis to points in Wisconsin, and along the west coast from the San Francisco area to points in the State of Washington.

The movement of cane blackstrap to east coast yeast producers is directly from offshore areas to such molasses consumers. The offshore supplies are obtained both by direct purchase and through importer-distributors. Beet molasses that originates in the eastern beet area--Michigan, Ohio, Wisconsin, Minnesota, and Iowa--is sold directly to east coast yeast firms through sales agents acting on behalf of beet processors. A development during the last half of 1950 was the importation of large quantities of beet molasses from Italy, the Netherlands, and other European countries at prices below the "going" market for domestic beet molasses. This somewhat changed the movement pattern for beet molasses produced in the eastern beet area. Shipments were made to the Chicago-St. Louis area to a greater extent than usual. The beet molasses market was generally depressed in all sales areas.

Yeast firms in the Midwest purchase cane blackstrap from Louisiana and Florida either directly from producers or from their sales agents. These firms also make purchases from distributors who resell domestic cane blackstrap and who also import cane blackstrap molasses. Also, the beet molasses purchased is usually confined to

that produced domestically and it originates both in the eastern beet area and in the intermountain area of Utah, Idaho, Colorado, and Wyoming. When eastern area molasses is needed on the east coast, most beet molasses used by these Midwest firms moves from the intermountain region. However, during the last 2 years, imported beet molasses also moved to these yeast firms and further depressed the over-all beet molasses market.

West coast yeast firms generally buy their cane blackstrap supplies from an importer who brings molasses in from Hawaii. Beet molasses is purchased directly from beet companies operating in the far western production area.

Prices to yeast companies are usually f. o. b. tanker in foreign ports if molasses is purchased from offshore sellers, but if purchased from domestic importer-distributors in tanker lots, prices are most often on a c. i. f. basis at the water terminal nearest the processing plant. Tankcar price quotations are f. o. b. tankcar at originating points, either at mainland production points or port terminals. Both beet molasses and cane blackstrap are purchased on the same basis.

Most yeast companies negotiate with foreign sellers of molasses before or early in the cane-or beet-processing season and agree on a firm price for molasses to be shipped during and after the producing season. Supply contracts with importer-distributors are also negotiated as early as possible after the distributors have made their offshore purchases. Contracts with domestic beet molasses producers are usually signed early in the beet-processing season because of the need of an assured source of molasses supplies and because beet factories often must sell because of lack of facilities for storing their production.

Domestic beet molasses from the eastern beet area for use in citric acid production is usually purchased through a beet molasses broker. Foreign beet molasses supplies may be obtained either through a domestic importer or directly from foreign sellers. When cane blackstrap is needed, it is obtained from domestic importer-distributors.

Cane molasses for vinegar production is purchased directly from offshore sellers, from importer-distributors, and through brokers or from producers of domestic cane blackstrap.

Marketing Margins and Cost

Producers of beet molasses have been greatly affected by the importation of foreign beet molasses and the substitution of cane molasses for beet molasses in the production of yeast. Marketing charges are such that very low net returns can be realized by United States processors and producers if delivered prices of domestic beet molasses are competitive with delivered prices of foreign beet molasses and are not over \$2 or \$3 a ton more than domestic and offshore cane blackstrap prices.

Although prices of molasses delivered to yeast, citric acid, and vinegar plants were much higher in 1951 than in 1950, the relationships between marketing costs for cane and beet molasses from the several supply sources were approximately the same in the two periods. Beet molasses imports increased during 1951 and further aggravated the problem of disposing of domestic beet molasses in normal sales areas and at prices comparable to the delivered price of cane blackstrap in interior areas.

The great difference as of mid-1950 in the cost of moving beet molasses from European ports and from the eastern beet molasses production (Michigan) area to east coast plants is shown in table 9. The marketing cost of the eastern beet molasses was \$14.50 a ton and of the imported, \$7 per ton. Ocean freight from European points was very low and this competition resulted in eastern beet molasses producers accepting an average net price of \$16.40 per ton as compared with about \$20 a ton received by producers in Europe, in order to compete in this market. Also, the competition of eastern area molasses in the Chicago-St. Louis area tended to force prices down in the intermountain and western beet areas.

The marketing cost structure of cane blackstrap delivered from Puerto Rico to yeast plants in the St. Louis-Pekin area indicates the reason why cane blackstrap was being substituted for beet molasses. The delivered price of cane molasses was about \$20.20 a ton (table 10). If yeast producers had been willing to pay a premium of \$3 a ton for beet molasses, intermountain beet processors would have received less than \$10 a ton net when freight rates of \$15 plus handling charges and sales fees were subtracted from delivered prices. Several petitions had been filed by yeast companies and beet processors in an attempt to obtain lower West-East freight rates, but so far they have not been successful in obtaining desired decreases. These high freight rates have resulted in yeast companies increasing the proportion of cane blackstrap in the

Table 9.--Comparative costs of marketing domestic and imported beet molasses from specified points to New York City, mid-1950

| Michigan | | | European ports | | |
|---|---|------------------------------------|---|---|------------------------------------|
| Item | Cost per ton ^{1/} <u>Dollars</u> | Cost per gallon <u>Cents</u> | Item | Cost per ton ^{1/} <u>Dollars</u> | Cost per gallon <u>Cents</u> |
| Handling charges by processor and sales fee | 2.50 | 1.5 | Ocean freight and insurance | 3.00 | 1.8 |
| Freight and handling costs in transit | 11.00 ^{2/} | 6.5 ^{2/} | Unloading local freight, handling charge, and sales fee | 4.00 | 2.4 |
| Terminal handling and other charges | 1.00 | .6 | | | |
| Total marketing cost | 14.50 | 8.6 | Total marketing cost | 7.00 | 4.2 |
| Net price Michigan | 16.40 | 9.5 | Price f.o.b. European port | <u>19.85</u> | <u>11.7</u> |
| Total delivered cost | 30.90 | 18.1 | Total delivered cost | 26.85 | 15.9 |

^{1/} A ton of blackstrap molasses is equivalent to 170.2 gallons.

^{2/} Work is being done toward the use of water transportation from the Saginaw, Mich. area all the way to East Coast molasses consumers. It is estimated that this operation will save from \$2.00 to \$2.50 per ton on freight rates.

Table 10.--Approximate costs of marketing blackstrap molasses from Puerto Rican ports to yeast plants in the St. Louis-Pekin area, mid-1950

| Item | Cost per ton | Cost per gallon |
|--|----------------|-----------------|
| | <u>Dollars</u> | <u>Cents</u> |
| Ocean freight, and handling charges and sales fee at New Orleans | 5.10 | 3.0 |
| Rail freight, New Orleans to St. Louis-Pekin area | <u>4.90</u> | <u>2.9</u> |
| Total marketing costs | 10.00 | 5.9 |
| Price f.o.b. Puerto Rican ports | <u>10.20</u> | <u>6.0</u> |
| Total delivered cost | 20.20 | 11.9 |

blend normally used and this has convinced many beet processors that a higher net return can be realized if feed markets in nearby areas can be supplied.

Practically the same cost structure for cane molasses would also be experienced for deliveries to east coast yeast plants. Freight rates and handling charges of approximately \$6.00 added to the f. o. b. Puerto Rican port price of \$10.20 a ton resulted in delivered prices in mid-1950 of \$16.00 to \$17.00 a ton. Again, net prices to domestic beet producers would be less than \$10.00 a ton if a premium of \$3.00 a ton were paid for beet molasses.

Another development in cane molasses marketing has been the use of barge shipments to yeast and vinegar plants in Cincinnati, the Chicago area, and along the Mississippi River. These large consumers of molasses are on or near water terminals, have considerable molasses storage capacity, and can use shipments as large as 400,000 gallons without splitting the cargo with other users. For instance, in 1950, large users in Cincinnati could receive molasses by barge from New Orleans for approximately \$23.50 a ton. This resulted in savings of about \$2.50 a ton since tankcar freight rates were \$10.00 a ton as compared with barging costs of about \$7.50 a ton. Comparable savings were made on shipments by barge to Chicago and Milwaukee. Barges had not been used to St. Louis and Pekin to any extent before 1950 since rail rates were so low that savings by barge shipment were almost nothing. These savings in the marketing cost for cane blackstrap resulted in midwestern yeast and vinegar users bidding lower prices for beet molasses.

UTILIZATION OF INDUSTRIAL MOLASSES AS LIVESTOCK FEED

Trends in Utilization of Industrial Molasses for Feed

The foregoing discussion of molasses utilization in the alcohol industry has pointed out the need for increasing molasses utilization in other ways. The molasses distributing trade, the feed-mixing trade, farmer cooperatives, and producers of industrial molasses believe that the utilization of molasses in mixed livestock feeds, grass silage, and dried high-molasses-content products, and also for direct farm feeding offers the only possibility for market expansion sufficiently adequate to maintain molasses utilization at a level which will prevent burdensome surpluses of this commodity.

The trend toward increased utilization of molasses for feeding livestock has been pointed out in a previous publication, entitled

"The Marketing of Feed Molasses." 8/ Estimates were given with respect to the utilization of cane and beet molasses in livestock feeds. However, these figures do not include quantities of hydrol and citrus molasses used in the feed industry. The present report shows estimates of the total amount of molasses used in feed, including hydrol and citrus molasses (table 11; fig. 2). Also shown in table 11 and figure 2 is a price comparison between corn and molasses in New York City. This comparison is based on 6-1/2 gallons of molasses being the carbohydrate equivalent of 1 bushel of corn or, in other words, that molasses has 70 percent as much carbohydrate value as corn on a pound-for-pound basis. The average price relationship between corn and molasses in 1950 made it the most favorable year for molasses utilization in the period studied, and feed mixers and farmers made large investments in molasses feed-mixing and direct-feeding equipment. By July 1951, this relationship was less favorable for molasses use because molasses price increases relative to corn prices made molasses the more expensive feed on a carbohydrate basis. It is estimated that almost 267 million gallons of molasses were consumed as livestock feed in 1950, while approximately 200 million gallons moved into this industry in 1951. However, because of the rapid investment in molasses-blending equipment and the greater acceptance of molasses by feed mixers and farmers as a feed ingredient molasses feed use did not fall as rapidly because of its high cost as compared with corn as it had in past years.

Molasses has advantages other than price as a component of a feed mix, in the feeding of roughage, or for grass silage. Molasses is used to add palatability to feed, to salvage feed which could not otherwise be used effectively, to keep down dust in feeds, and as a binding agent. 9/ It is doubtful that temporary increases in molasses prices to the level where the delivered price of 6-1/2 gallons is equal to or slightly greater than the laid-down cost of a bushel of corn would greatly reduce the use of molasses livestock feed. Farmers and feed dealers would find it necessary to weigh the increased cost for molasses against the value of the feed that might be lost through failure to use molasses. Moreover, it is not feasible for feed dealers to change their formulas often merely to take advantage of short-run price changes. The fields of marketing in which the greatest reduction in molasses utilization for

8/ See footnote 1 on page 1.

9/ Many Federal and State Experiment Station livestock feeding tests concerning utilization of molasses in livestock feeds are summarized in the book entitled "Feeds and Feeding" by F. B. Morrison. pp. 450, 451, 528, 529, 665, and 756.

Table 11.--Relationships between the New York City corn-molasses price and the estimated volume of industrial molasses used in feed, 1935-51

| Year ended June 30 | Price of 1 bu. of corn minus the price of $6\frac{1}{2}$ gals. of molasses 1/ | Estimated quantities of molasses used in livestock feeding |
|-----------------------|---|--|
| | <u>Cents</u> | <u>Million gallons</u> |
| 1935 | / 49.8 | 142.4 |
| 1936 | / 33.5 | 102.7 |
| 1937 | / 76.0 | 171.2 |
| 1938 | / 40.1 | 136.9 |
| 1939 | / 26.7 | 101.8 |
| 1940 | / 33.1 | 93.0 |
| 1941 | / 33.9 | 149.6 |
| 1942 | / 2.4 | 94.4 |
| 1943 | - 6.7 | 64.4 |
| 1944 | / 6.2 | 76.7 |
| 1945 | / 11.4 | 83.8 |
| 1946 | / 14.9 | 102.1 |
| 1947 | / 62.2 | 128.2 |
| 1948 | / 55.5 | 164.5 |
| 1949 | / 70.6 | 197.4 |
| 1950 | / 103.9 | 266.8 |
| 1951 | - 2.9 | 200.5 |
| July 1951 | - 37.3 | - |

1/ $6\frac{1}{2}$ gallons of molasses is the carbohydrate equivalent of 1 bushel of corn.

Source: 1935-49 adapted from "Marketing of Feed Molasses" by Kutish, L. John, Sugar Branch, FMA. USDA. Feb. 1950, table 6, page 10. Hydrol and citrus molasses is added for the above period. Corn prices for 1950 are from Division of Statistical and Historical Research, BAE.

UTILIZATION
(MILLION GALLONS)

PRICE OF A BUSHEL OF CORN
MINUS PRICE OF 6-1/2 GALS OF MOLASSES
(CENTS)

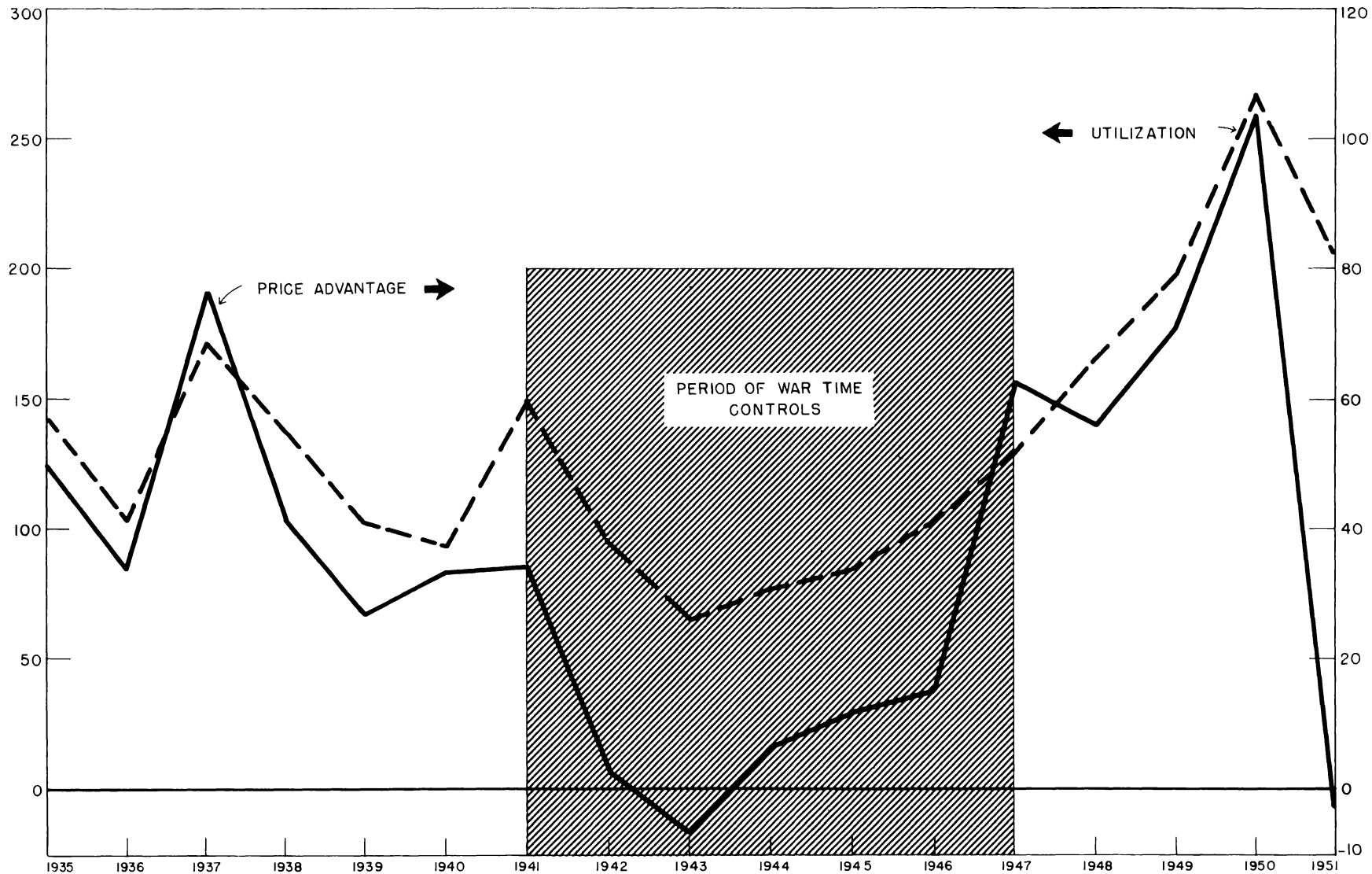


Figure 2.--Price advantage (or disadvantage) in feeding blackstrap molasses to livestock, and utilization of all molasses for livestock feeding.

feeds occurs in times of high molasses prices relative to grain are in direct feeding on farms and in feeds in which very high percentages of molasses, 15 to 20 percent or more, are normally used. When the outlook for periods of from 6 to 18 months is for high molasses prices relative to corn prices on a feed-value basis, molasses content of all prepared livestock feeds will usually be lowered but not excluded from mixes. For example, in the spring of 1951 many mixers decreased molasses content of feeds from 8 to 15 percent to 5 to 8 percent.

The following sections describe the types of industrial molasses utilized by the feed-mixing trade, in direct feeding on farms, and in grass silage; and the distribution and use of molasses in these utilization categories. Special emphasis is given to distribution practices that offer possibilities of decreasing marketing costs and increasing molasses consumption.

Types of Industrial Molasses Utilized by Feed Mixers

Interviews with feed mixers indicated that cane blackstrap is preferred to other types of inedible molasses. Cane blackstrap or refiners' blackstrap is preferred because of the sales appeal it gives and the end product of feed manufacture and the lack of mechanical difficulties in the mixing process. Farmers and feeders have become accustomed to the sweet odor and the moist feel of feeds containing cane blackstrap.

Beet molasses has not been used to any great extent by feed mixers during the last few years because of the heavy demand for beet molasses in yeast and citric acid and the premium price usually paid by these types of users. Beet processors stated that some mixers and feeders object to the taste of beet molasses and to its laxative effect as compared with cane blackstrap. However, they stated that cattle in many areas around beet-processing plants readily ate beet molasses or feeds containing more than 20 percent of beet molasses by weight and that reasonable care in limiting quantities placed in mixed feeds or fed direct would do away with the latter objection.

Considerable expansion of interest in utilization of beet molasses was shown by feed mixers during the last half of 1950 and the first half of 1951. This was particularly true in the area from Denver westward and in Nebraska, the Dakotas, and other States near the Rocky Mountain beet-production area. These mixers were often able to purchase beet molasses at a discount under cane blackstrap on a delivered price basis and beet processors were able to realize a higher net return, f. o. b. the beet-processing plant, than for sales to yeast and citric acid processors.

Beet processors had received few complaints from feed mixers because of either the taste or laxative effect. Mixers have used beet molasses straight or have blended beet and cane blackstrap.

Producers and sellers of beet molasses currently put much more stress on the sale of their product to the feed trade located in their immediate area and to sections where transportation rates are not out of line with rates for supplies of cane blackstrap. Competition from beet molasses imported from Europe in the heavy-consuming eastern market and the substitution of cane blackstrap for beet molasses in yeast production have made this course necessary.

Hydrol does not furnish the sweet odor of cane blackstrap nor does it give feed the moist feeling that farmers expect, because of its quality of greater and more rapid penetration of feed material. The wet corn milling industry recognizes these facts and points its sales program toward selling hydrol at a price discount for blending with cane blackstrap. Large-scale feed mixers, especially those near hydrol supply sources, have been successfully mixing up to 50 percent hydrol in their molasses blends, as well as straight hydrol, to take advantage of price differences. Hydrol was not used by many mixers because of past mechanical problems. The dextrose in hydrol crystallized in transit and in storage and caused clogging of mixing equipment. However, this disadvantage recently was overcome by the addition of an alkali to arrest dextrose crystallization.

Part of the feed industry indicated that cattle may be slow to eat feed containing hydrol if they have been accustomed to the odor and taste of cane molasses. However, they become accustomed to it and no appreciable change in feed consumption is apparent. Cattle which have not been eating cane blackstrap feed will eat large quantities of feed with hydrol in it. There is little choice between the two as far as nutrition is concerned.

Citrus molasses also differs in odor and taste from cane blackstrap but the major reason given by feed mixers for not using this type of molasses was the difficulty of mixing it mechanically. Citrus molasses production did not begin until 1943, and because of the newness of the production process, much of the citrus molasses produced contained considerable foreign material. Since it had been processed by the citrus industry primarily as a waste-disposal measure, the industry did not feel that the additional expenditure required for further processing was justified, especially early in 1950 when molasses prices were so low. Instead, a sales promotion program directed toward direct farm

feeding, in which foreign matter posed no problem, was started and proved very successful. However, with much higher prices and increased production in 1951, almost all producers were clarifying citrus molasses to remove foreign matter and were making sales to feed mixers.^{10/}

Distribution of Molasses Used by Feed Mixers

Location of Terminals, and Marketing Agencies Involved

A small group of importer-distributors specializes in purchasing cane blackstrap and refiners' blackstrap for use by the feed industry from the Cuban Sugar Stabilization Institute, distributors and producers in Puerto Rico, Hawaii, and various foreign supply areas, and from continental molasses producers and brokers. These importer-distributors operate terminals capable of receiving tankers, usually carrying approximately 1,800,000 to 2,000,000 gallons of blackstrap, and have their own domestic sales organization. They also sell large lots of foreign supplies to other domestic distributors who also operate terminal facilities. These latter distributors make the actual domestic sales contacts but do not make contacts with foreign suppliers. Both types of distributors, however, are first buyers of domestic cane and refiners' blackstrap. The major molasses-receiving terminals are in New Orleans, Baltimore, Philadelphia, Houston, Albany, Buffalo, Portland, Oreg., Seattle, and Los Angeles. Smaller terminals for handling feed molasses are in New York City, Mobile, Jacksonville, Norfolk, Buffalo, Boston, Savannah, Richmond, and Stockton.

When the molasses market price outlook is favorable, the bulk of foreign supplies are purchased well before the cane harvesting and processing season. When the molasses market is weak, and old-crop supplies are also on the market, foreign supplies are purchased as needed, since domestic importer-distributors want to minimize price risks.

As in the case of molasses purchases by the ethyl alcohol industry, importer-distributors of feed molasses purchase offshore supplies f. o. b. tanker in offshore ports on a 52 percent sugar basis. Domestic prices

^{10/} Orange and grapefruit peels and pulp are run through a hammer mill and chopped, water and juice are pressed from this waste material, and the resulting liquid is run into multiple-effect evaporators where excess moisture is driven off. Citrus molasses of about 39° Baume or 71° Brix and 41 to 45 percent total sugars is the end product of this moisture evaporation.

are quoted f. o. b. tankcar at the port terminal. Sales to feed mills and farmers are based on 42° Baumé which usually results in approximately 50 percent total sugar in molasses used in mixed feeds, silage, and direct farm feeding.

A substantial proportion of the Louisiana molasses supplies is often contracted for in advance of the sugar-processing season. These sales contracts normally call for price determination on the basis of the season's average price received by producers as determined by the Louisiana Sugar Exchange. The price quoted by the Louisiana Exchange is the first sale of molasses; that is, the contract entered into on a firm price basis between the producer and a molasses distributor. These sale prices are reported by both producers and distributors. Daily prices are quoted only on sale units of 5 tankcars, the daily price being a weighted average of unit sales. Weekly average prices are a simple average of daily prices. In turn, the season's average price is a simple average of the weekly average prices. These Exchange prices are quoted on an f. o. b. mill basis. However, tankcar shipments carry the same rate from the mill to the ultimate destination as those from New Orleans to the ultimate destination. Therefore, the Exchange price is assumed to be the same as an f. o. b. New Orleans price. During the summer and early fall of 1950, distributors contracted to buy more than three-fourths of the Louisiana production on the season's average price basis.

More than one-half of the Louisiana crop not sold prior to the beginning of the processing season is sold through brokers representing cane blackstrap producers. Normally, at least 85 percent of the Louisiana crop moves to the feed trade, the balance going largely to the yeast trade. Nearly all molasses produced in Louisiana, regardless of the identity of the first buyer, moves by tankcar from the sugar mill to the consumer.

Virtually all blackstrap molasses produced in Florida is sold by the largest producer operating in the State. This producing firm acts as a molasses distributor and sells the company production, as well as most of that produced by the remaining sugar mills, in tankcars and tanktrucks throughout the year. Florida molasses prices are usually quoted f. o. b. Clewiston and follow the current New Orleans market.

Refiners' blackstrap is usually sold through a molasses distributor who already has a sales organization. Individual plants produce relatively small quantities of refiners' molasses, have facilities for storing only

from 1 to 2 months' production, and prefer selling through established feed molasses distribution channels. About 80 to 85 percent is sold to the feed industry. Price quotations to users are f. o. b. tankcar or tanktruck at the point the refinery is located or on an f. o. b. basis equivalent to the nearest major port terminal.

Cane molasses distributors, including those who sell refiners' blackstrap, do not sell tankcar lots direct to small feed mixers who use such small quantities of molasses that direct sales contacts and the scheduling of deliveries would be unduly costly, as well as difficult. Instead, small mixers obtain their supplies through local brokers, who handle all types of grain and raw materials for feed mixing, or from larger feed mixers in the area. Molasses distributors consider the use of these market middlemen the most efficient method of making tankcar sales to small users and are willing to pay intermediate handlers from \$15 to \$20 per tankcar for performing this selling service. Brokerage rates are usually lower in the southern and midwestern areas than in the northeastern United States.

Beet molasses that moves to the feed trade is sold mostly by molasses producers through regular feed brokers located in the consumer's area, or directly to feed mixers. However, molasses distributors have been purchasing beet molasses from producers during the last 2 or 3 years for resale to processors of livestock feed. Beet molasses is usually quoted on a delivered basis by interior producers and by distributors purchasing molasses at these points since the locations of beet factories are such that each factory would carry a different f. o. b. price to arrive at a common delivered price. West coast beet molasses price quotations, in the only production area near a molasses port terminal, are on the same basis (f. o. b. tankcar) as imported cane blackstrap.

Producers of hydrol utilize their own sales organization for the sale of an estimated two-thirds of their total sales to the feed trade. The remaining one-third is sold through brokers. Brokerage fees are approximately \$12 a tankcar in the Midwest, where most sales are made. Hydrol is usually sold on a delivered basis. Virtually all hydrol production is used in feeds.

Most citrus molasses is sold within the State of Florida, where it is produced. Producers of this type of molasses are in close contact with farmer feeders and feed mixers, and sell more than three-fourths of their production directly to the end user. The remainder is sold through a sales agent representing approximately six citrus molasses

producers. Citrus molasses prices are quoted f. o. b. the citrus processing plant and delivered prices to consumers vary slightly according to the location of the shipping point in relation to the user's plant.

In addition to tankcar movements, many molasses distributors and farmer cooperatives located near water terminals are using tanktrucks to move molasses to feed mixers and farmers. No intermediary is used for most tanktruck sales. Molasses distributors handle these sales directly. Farmer cooperatives purchase blackstrap directly from distributors and move molasses by tanktruck to their member organizations.

Marketing Spreads and Costs

The most important factors affecting marketing spreads and margins in the movement of molasses from producers to consumers are: (1) Trend of molasses prices after purchase of domestic and offshore supplies by domestic distributors; (2) variation in ocean freight rates and handling costs; (3) the distance molasses is transported from domestic terminals; (4) the type of transportation used in moving molasses from mainland terminals to consumers; and (5) the unit size of the purchase made by the individual consumer, measured by tankcar, tanktruck, or barrel.

It is difficult to set up a simultaneous marketing operation showing exact marketing margins and costs at a particular instant. Most molasses supplies for domestic use are purchased early in the year in Puerto Rico and Cuba and sold by distributors throughout the year. Consequently, the tables that follow show a purchase price in Puerto Rico in early 1950 and the price in domestic port terminals in mid-1950. This method of showing actual price spreads in 1950 seems to be more meaningful than to show differences between prices at the same time. Several of the marketing charges are exceedingly variable, particularly ocean freight rates and certain terminal handling costs, such as fuel and labor. No attempt is made to estimate normal margins and costs.

Because of the differences in marketing spreads and margins, the following discussion will be concerned first with the situation confronting the large feed mixer and second with that for the small feed mixer.

Large Feed Mixers

The greater part of the molasses moving into the large mid-western mixed feed centers, such as St. Louis, Kansas City, Chicago, and Minneapolis, moves in tankcars containing approximately 8,000 gallons. The approximate price structure for molasses moving from mills in Puerto Rico through the port of New Orleans to a large feed mill in Minneapolis during early summer in 1950 is shown in table 12.

Table 12. --Approximate cost of marketing blackstrap molasses from Puerto Rican mills to Minneapolis, mid-1950

| Item | Cost per ton ^{1/} | Cost per gal. |
|---|----------------------------|---------------|
| Transportation, handling, storage, and assembler's mark-up | Dollars 2.50 | Cents 1.5 |
| Ocean freight, handling, storage, and distributor's mark-up | 8.50 | 5.0 |
| Rail transportation from New Orleans to Minneapolis | 15.30 | 9.0 |
| Total marketing cost | 26.30 | 15.5 |
| Mill price net, interior Puerto Rico | 7.70 | 4.5 |
| Total delivered cost | 34.00 | 20.0 |

^{1/} A ton of blackstrap molasses is equivalent to 170.2 gallons.

The marketing price structure is estimated in table 13 for a large feed mixer located in central New York near the port of Albany, the most important terminal for feed molasses distribution in the New York area. Molasses is brought into Albany by ocean-going vessels and is moved to feed mills by rail

Table 13. --Approximate cost of marketing blackstrap molasses from Puerto Rican mills to central New York State, mid-1950

| Item | Cost per ton <u>1/</u> | | Cost per gallon | |
|------------------------------------|------------------------|-------|-----------------|------|
| | <u>Dollars</u> | | <u>Cents</u> | |
| Transportation, handling, storage | : | : | : | : |
| and assembler's mark-up | : | 2.50 | : | 1.5 |
| Ocean freight, handling, storage | : | : | : | : |
| and distributor's mark-up | : | 11.10 | : | 6.5 |
| Rail transportation from Albany to | : | : | : | : |
| cities in central New York | : | 5.10 | : | 3.0 |
| Total marketing cost | : | 18.70 | : | 11.0 |
| Mill price net, interior | : | : | : | : |
| Puerto Rico | : | 7.70 | : | 4.5 |
| Total delivered cost | : | 26.40 | : | 15.5 |

1/ A ton of blackstrap molasses is equivalent to 170.2 gallons.

The differential in distributor margins in New York and New Orleans has previously been explained on page 10. (The delivered price for molasses used by mixers in central New York was 4.5 cents per gallon less than that for mixers in Minneapolis.)

The primary difference in the marketing margins for the two areas was the charge for transportation from the mainland port terminal to the feed mixer. Transportation charges to Minneapolis from New Orleans amounted to 9 cents, or slightly more than 45 percent of the delivered price of molasses, while transportation costs from Albany to a central New York feed mixer were only 3 cents, or about 20 percent of the total delivered molasses price.

Ocean freight, handling, and distributors' margins were quite high in both New Orleans and Albany--5 cents or 25 percent of the delivered price in the former city and 6.5 cents or about 40 percent of the final cost to the feed mixer in the latter. Relatively high margins in mid-1950 were due, at least in great part, to the upswing in molasses prices after distributors had made purchases of offshore and domestic molasses early in the year. Molasses prices in Albany are normally quoted at 1/2 cent higher than in New York City because of higher ocean freight rates.

By early August 1951, molasses prices at Albany and New Orleans had tripled as compared with mid-1950 prices. The great demand for alcohol, the bidding of alcohol fermentation producers for this raw material, and the desire of the feed trade and other users to obtain their share of a relatively limited supply had provided a heavy pull on prices of blackstrap molasses. Data on marketing margins and costs for 1951 are not presented here, since market prices and costs were abnormally high. Data presented for mid-1950 are much more realistic and representative of the margins and costs likely to prevail in the future.

Mixers located within about 200 miles of Albany now have the choice of receiving molasses either in tankcars or in tanktrucks. This option is also open to consumers near all other ports, except New Orleans. Many large mixers prefer to receive molasses in from 3,000 to 3,500-gallon lots in tanktrucks. Truck rates are usually based on rail rates and from 1/2 to 1 cent per gallon may be added for the additional handling cost incurred in truck deliveries. Larger feed mixers, although they have facilities for receiving tankcar lots, are willing to pay slightly more for truck deliveries because (1) smaller inventories may be carried; (2) delivery by truck is much faster and more dependable than by rail; (3) since trucks are insulated and molasses is preheated at the distributor's plant, feed mixers have no problem of pumping or expense of labor for getting molasses into plant storage tanks; and (4) those who normally receive molasses by rail find truck delivery an advantage when rail shipments are delayed. Also important in the northeast area is the fact that many feed mixers make delivery of their finished products by truck and do not have to consider the milling-in-transit privilege 11/ allowed by railroads as a marketing cost when comparing the two types of transportation.

Much has been said about using barges to move molasses to feed-mixing areas in the Midwest where rail transportation is very expensive. Actually, the difference between freight rates in barging and shipping by rail or truck to feed-mixing areas has not been too important, although a simple comparison of freight rates gives the impression that great savings would ensue by use of barges. As an example, the

11/ The "milling-in-transit" privilege is a privilege granted by railroad carriers that allows feed mixers through rates from original point of loading to final sale destination instead of a combination of higher local rates for commodities such as grain and molasses that are stopped in transit for processing.

difference in freight rates from New Orleans to Minneapolis would amount to about 3-3/4 cents a gallon. However, when all the charges additional to the costs of barging are accounted for, only relatively small savings are made. These added charges include operation of terminal facilities at destination, loss of 1 to 2 percent of the shipment in transit, transportation by truck from the terminal to the feed mixer, and loss of in-transit privileges on outbound shipments from large mixing plants. The last-mentioned item is the largest additional expense.

Other factors also help to explain the limited use of barge shipments to feed-mixing areas. Approximately 400,000 gallons of molasses constitutes a barge load. This quantity involves considerable investment as well as price risk since it often takes from 4 to 6 weeks to barge from New Orleans to Minneapolis. Distributors and consumers have been reluctant to assume these risks. Also, because of the quantity involved, shipments can be made only to very large centralized consuming centers since the addition of trucking costs from barge terminals to consumers limits the area that can be served economically from river ports. When truck shipments of molasses from Minneapolis or other inland water terminals exceed 25 to 35 miles, rail shipments are more economical and are used by large mixers.

Another limiting factor has been the lack of terminals and the reluctance of the distributing trade to make the necessary investment in such facilities. There is always the possibility of railroads lowering freight rates sufficiently to make barge shipments too expensive for shipping molasses to feed mixers. Storage facilities also are necessary in the more northern points inasmuch as molasses must be stored during warm months, when rivers are open, until the heavy molasses-consuming winter months, when rivers are frozen and no longer passable.

The physical handling process in the movement of molasses from production areas to large feed-mixing plants, with facilities for receiving and storing large tanktruck shipments or tankcar lots of molasses, is an efficient one. Also, very few market middlemen are involved in the purchase and sale of molasses used by large feed mixers. The wide margin between the price received by producers in offshore areas is usually the result of long, expensive vessel and tankcar transportation and the handling of a bulky and relatively low-cost commodity. Not to be forgotten is the risk assumed by middlemen involved in the purchase and sale of a commodity with a history of vast price fluctuation. Margins obtained by these marketing agencies could be reduced if the utilization of molasses in livestock feeds could be increased and greater market stability maintained.

Small Feed Mixers

Many mixers with no facilities for receiving tankcar lots of molasses, either because of location or because of the cost of installing sufficient storage facilities, have been receiving high-cost molasses in barrels and have made no attempt to install molasses feed-mixing equipment. In some instances molasses has not been available in small quantities and in others it has been too expensive in relation to other feedstuffs.

In the northeastern United States, on the West Coast, and in Florida, Georgia, a section of Virginia, and Texas, molasses distributors, farmer cooperatives, and motor transport companies have been doing a great deal to decrease marketing costs for moving small shipments of molasses. Tanktrucks have been used to make molasses available to farmers and mixers located away from rail points at prices much below those for molasses sold at retail in barrels. The opinion of the molasses distribution trade is that this market has barely been tapped and that there remains a large potential.

Molasses distributors and farmer cooperatives usually do not own the trucks for transporting molasses but have contracts with petroleum transportation agencies. Rates are comparable to rail tankcar charges. Deliveries are made to small feed mixers who have facilities for receiving at least 1,000 gallons; either small tanks or barrels can be used. Molasses prices are quoted on a delivered basis to these smaller consumers.

To use Albany as an example, a small feed mixer located approximately 150 miles from this water terminal can save approximately 6.5 cents a gallon or approximately \$11 a ton by receiving molasses by tank-truck rather than in barrels delivered to his mixing plant (table 14). This difference in marketing cost was the major reason given by two farmer cooperatives operating in the northeastern United States for the rapid increase of truck delivery of molasses in this area.

Table 14. --Comparative cost of delivering blackstrap molasses in tanktrucks and barrels from Albany to small feed mixers located 150 miles from port, mid-1950

| Item | Cost per gallon | |
|---------------------------|--------------------|-------------------|
| | Tanktruck delivery | Barreled delivery |
| | <u>Cents</u> | <u>Cents</u> |
| Handling or barreling fee | 1.0 | 5.5 |
| Transportation | <u>3.0</u> | <u>5.0</u> |
| Total marketing cost | 4.0 | 10.5 |
| F. o. b. Albany <u>1/</u> | <u>12.5</u> | <u>12.5</u> |
| | 16.5 | 23.0 |

1/ F. o. b. Albany price based on sum total of items 1, 2, and 5 in table 13.

Very little has been done to make molasses available in smaller quantities at reasonable prices in the Midwest and in other areas 250 miles or more from coastal ports. Rural feed mixers in these inland farm areas offer a large market for molasses sales by tanktruck. Estimates of marketing costs obtained by applying marketing-cost data from other areas point out the possibility of lowering the delivered price of molasses in the Midwest by the use of tanktruck instead of barrel delivery (table 15). Truck delivery to small feed mixers would result in a saving of approximately 7 cents a gallon or slightly more than \$11 a ton on the basis of 1950 costs.

Table 15. --Comparative cost of delivering blackstrap molasses in tanktrucks and barrels from a dealer in Iowa to small mixers located 50 miles away, mid-1950

| Item | Cost per gallon | |
|---|--------------------|-------------------|
| | Tanktruck delivery | Barreled delivery |
| | <u>Cents</u> | <u>Cents</u> |
| Barreling and handling | : | : |
| feed and mark-up | 3.0 | 9.0 |
| Transportation to small feed mixer (50 miles) | 1.8 | 3.0 |
| Total marketing cost | 4.8 | 12.0 |
| Cost delivered to dealer | : | : |
| In Iowa | 17.5 | 17.5 |
| Delivered price to small feed mixer | 22.3 | 29.5 |

As in the case of tankcar deliveries of molasses, prices of molasses delivered to small feed mixers in tanktrucks and in barrels increased greatly from mid-1950 to August 1951. However, this increase in price would not affect the savings of truck delivery as compared with delivery in barrels.

Some men in the molasses distribution trade believe that large-scale feed mixers located in the Midwest have the best opportunity for starting and continuing the distribution of molasses in small lots by tanktruck. These feed mixers have established supply sources and already have storage facilities. Tanktrucks can be leased from petroleum sales and transporting companies. Little new investment would be necessary. Another factor of importance is the fact that several large feed-mixing companies did not feel that they would be creating new competition in feed sales. The small-scale feed mixers served would not necessarily increase their volume of production or sales but would substitute molasses as a part of the feed mix and eliminate some other ingredient or ingredients.

However, to expand molasses usage by and to facilitate its movement to small-scale mixers in many areas it will be necessary for existing or new molasses distributing agencies to expand their operations and set up tanktruck distribution stations at interior points.

Cost of Installing Molasses-blending Equipment

In the Northeastern States, molasses-blending equipment has been installed in many small mixing plants in order to take advantage of the savings in using molasses delivered by tanktruck as a substitute for the more expensive carbohydrate materials in feed products and to improve the quality of mixes. Most blending machines of the type for which costs are estimated below are used in conjunction with 150-cubic-foot vertical-type feed-mixing facilities. This vertical feed mixer, in mid-1950, cost approximately \$1,100, including the motor and v-belt drive. Installation and the necessary electric wiring cost approximately \$200.

The total cost of molasses pumping, storage, and blending facilities was approximately \$2,975 (table 16). Pumping facilities installed cost \$700; storage tank \$650; and molasses-blending equipment \$1,625.

Table 16. --Cost of molasses-blending equipment and its installation in small feed-mixing plants, mid-1950

| Item | : | Estimated cost |
|---|---|----------------|
| | : | <u>Dollars</u> |
| Molasses pump, motor, meter, valves, and necessary piping | : | 500 |
| Installation of pumping equipment | : | 200 |
| 5,000-gallon storage tank | : | 400 |
| Pipe and pipe fittings for tank hook-up with pumping facilities | : | 100 |
| Installation of storage facilities | : | 150 |
| 6-foot agitator-type blender, complete with motor, drive, & conveyor feeder | : | 1,225 |
| Installation of blender | : | <u>400</u> |
| Total cost | : | 2,975 |

Storage capacity should be twice the size of the anticipated unit of purchase. This safety feature is needed because of the difficulty in exact scheduling of molasses deliveries. Another feature of reserve storage capacity is that savings may at times ensue from receiving an entire tank truckload rather than a partial one.

The blender (mentioned in table 16), using a 7-1/2 h. p. motor, has a capacity of up to 10 tons of feed material per hour. Although such molasses equipment may have a maximum capacity greater than the expected volume of business, the reserve capacity can be used to take care of peak production periods and to allow for business expansion without additional investment. Also, the operation of the machine at a speed under its maximum capacity may increase its life and at the same time keep maintenance costs at a minimum.

Experience has shown that the above-mentioned blenders, when used with other mixing equipment operating at normal speeds, can mix from 10 to 12 percent molasses in feeds. When molasses prices are low relative to grain prices, the speed of operation may be slowed and the molasses content increased to as much as 15 percent.

Molasses-blending equipment is especially suited to areas in which custom feed mixing affords an opportunity for a profitable business, or custom blending can be used by small feed mixers to increase the size of their business above normal production for retail sales. Many large feed manufacturing firms produce highly concentrated protein and mineral supplements and make them available to small mixers and farmers. These supplements and other feed materials can be used in conjunction with whatever grain farmers have available. Also, the farmer's own formula can be used.

Molasses as an Ingredient of Feed Mixes

Molasses is recognized as a necessary ingredient in many feed mixes. It is widely used for dairy cattle, beef cattle, and work stock. Although many feed mixers have started using molasses in poultry and hog feeds during the last 2 to 3 years, its use in feeds for these animals is not as widespread as in feeds for other livestock. Morrison ^{12/} points out two of the major reasons for including molasses in mixed feeds when he writes: "Cane molasses is used as an ingredient in many of the mixed feeds, especially those for cattle and horses. It not only increases the palatability of these feeds, but is often one of the cheapest sources of carbohydrates for the feed manufacturer who can use it in tankcar lots."

^{12/} Morrison, F. B. Feeds and Feeding. The Morrison Publishing Company, 1946, page 396.

Dairy Feeds

As pointed out previously, a major factor affecting the amount of molasses used in feeding is the relationship of molasses to corn prices. However, all the feed mixers interviewed considered the inclusion of a minimum of from 6 to 10 percent molasses in dairy feeds as a necessity, regardless of its price in relation to corn. This was true mainly because of the palatability factor, the appetizing effect that causes cattle to increase consumption of water and feed, which, in turn, results in increased milk production. Such a proportion of molasses also results in the settling of dust, the binding together of components of the mix, and moist sweet-smelling feeds with a high degree of sales appeal.

Most mixers produced other dairy feeds containing high percentages of molasses--from 15 to 36 percent of the total mixture. Molasses was used in conjunction with rather unpalatable grain products, such as oat mill screenings. Because molasses prices were very low in relation to corn during the summer of 1950, the greatly increased quantities of molasses were included in these mixes and retail prices kept at very low levels relative to feeds containing corn and other grains.

When less favorable molasses-corn price ratios occur, the sales of such feeds may be sharply curtailed because the use of feeds containing large quantities of grain and corn may provide more economical sources of carbohydrates for livestock.

Beef Cattle Feed

In cattle-feeding areas of the West and Midwest, beef cattle molasses feeds are used both in range feeds and in fattening or finishing rations. A popular type of range feed is a mixture processed into pellet or cube form. These pellets contain from 15 to as high as 35 percent molasses and generally are easy to feed. Several feed mixers stated, however, that range rations containing as much as 35 percent molasses were too sticky for use on the range and that such pellets disintegrate quickly when wet. They also stated that until better processing equipment is available, the molasses content, to be practical, should be somewhat below the maximum quantities being marketed in pellets by a few firms. Most fattening or finishing rations are processed into meal or cake feeds. Cookers and driers are used to get as much molasses as possible into these formulas, and molasses content sometimes constitutes 45 percent of the mixture. High-molasses-content feeds were very popular with

cattle feeders at the time this survey was made because of their palatability and low cost and because their use resulted in increased consumption of water by cattle.

Poultry, Hog, and Work Stock Feeds

Few of the feed mixers interviewed used molasses in poultry feeds. The major objection came from the difficulty of mixing molasses in poultry mashes. Molasses tends to roll into small masses, and individual birds consume quantities large enough to disturb their digestive processes. There was considerable disagreement among individual feed mills as to whether palatability was as important in poultry feeds as in dairy and beef cattle rations.

In none of the various poultry rations did molasses content exceed 2-1/2 percent of the total weight. Feed mixers were able to use these small quantities to bind feed materials and considered molasses important from the standpoint of its mild laxative effect. Molasses was also being used because of its economy as a carbohydrate feedstuff as compared with corn. Several mixers were greatly interested in a dehydrated molasses product that could be utilized in poultry mashes, thus solving the problem they now have of mixing wet molasses with poultry feeds. Most mixers were of the opinion that such a molasses product must be priced low enough to be competitive with corn on a carbohydrate basis, since molasses does not make large quantities of roughage-type feeds available for poultry and the matter of palatability is not so important as it is in dairy- and beef-cattle feeds. Experiments in feeding molasses to poultry have been rather limited and most recommendations are very general. Production research is needed to answer questions concerning the importance of molasses in affecting palatability of poultry feeds as well as concerning the practical quantity of molasses that may be fed.

More than one-half of the feed mixers interviewed included molasses as a part of hog feeds. These firms used hog feed formulas calling for from 2 to 4 percent molasses. Molasses is important as a binding agent in these rations, particularly those processed into cube form.

Molasses was used in horse and mule feeds by all mixers. Molasses contents varied from 5 to 15 percent of the rations. The usual formula called for 10 percent molasses in better quality feeds containing large quantities of grain and 15 percent in those feeds in which considerable portions of mill screenings in addition to grain are utilized.

Beet and Citrus Molasses Pulp

An important method of marketing beet molasses in the inter-mountain and far western beet production areas is on beet pulp. It is estimated that from 6 to 8 million gallons of molasses is sold in this form by beet processors. Another practice, limited primarily to the West Coast area, is the sale of beet molasses to yeast producers and the purchase of cane molasses for use on beet pulp. This has been true particularly in periods when beet molasses commanded a premium over cane blackstrap.

Beet molasses is combined with wet beet pulp and dried. Although the contents of the mixture vary, an average of 20 percent molasses is used. The important markets are for both dairy and beef cattle feeds. The mixture serves both as a roughage and as a concentrate feed.

Citrus molasses is also mixed with pulp. Citrus molasses and wet citrus pulp are mixed and dried to form a feed containing about 20 percent molasses and 80 percent pulp after the drying process is completed. Most of this feed is consumed by dairy cattle in Florida and nearby States and in the northeastern United States. This product has become important only during the last 5 or 6 years and has offered competition in the sale of beet molasses pulp both in the South and in the eastern dairy cattle area.

Dried High-Molasses Content Products

An important postwar development has been the processing of molasses into a concentrated, dried, easily handled form. These products are generally of high quality and with reasonable care in packaging and handling are not hygroscopic in nature. Manufactured primarily in the Midwest (Chicago and Iowa) and in Louisiana, these products contain from 40 to 75 percent molasses and from approximately 20 to 37 percent total sugars. One product contains hydrol, and cane blackstrap is the ingredient in all other dried products.

These products with high-molasses content may be divided into two general groups on the basis of molasses content and processing procedure: (1) One group contains 65 to 75 percent molasses, and is made by a combination process of dehydration of water in molasses and utilization of absorptive carriers, such as corn oil meal and bagasse pith, and (2) the other group contains from 40 to 45 percent molasses and is dried by absorption in oat millfeed and cottonseed and soybean meal.

The first group is sold in multi-wall paper bags containing 50 and 100 pounds, whereas the second type is packed in ordinary burlap bags in 100-pound lots.

High-molasses-content products were developed and are advertised for use in feed mixtures on farms, in small feed-mixing plants where purchasing and handling wet molasses is too expensive or impossible because of small sales volume or lack of equipment, and in grass silage. The major advantages of molasses products in this form are ease of handling as compared with 600-pound barrels of wet molasses; availability of small quantities of molasses; no problem of mixing a dry product with other ingredients as compared with blending molasses, particularly in cold weather; the elimination of the trouble and expense involved in diluting and heating liquid molasses; and the doing away with the need for molasses-blending equipment.

The principle of marketing molasses in dried form is undoubtedly a sound one but several factors combine to make the delivered cost to the consumer of the product too high, in comparison with corn or wet molasses, for over-all acceptance by the feed industry. Sales have been restricted to relatively small geographical areas and to small users whose individual purchases are limited in size. In June 1950, the delivered price of these high-molasses-content products to farmers and users in the Midwest varied from approximately \$85 to \$110 per ton, while the price of corn was slightly more than \$50 a ton. The delivered price of liquid molasses to a feed mixer with facilities for receiving tankcars was about \$28 to \$30 a ton. The comparatively high price of this special product helps explain why most feed mixers had not made use of it and why small unit purchases were made.

The recent survey indicated that plant location and processing costs were the major items affecting the delivered cost of the commodity. Plants producing and marketing the more popular high-molasses-content products are located in areas long distances from ports and molasses production areas. The plant in a molasses production area must pay outbound freight rates on the finished product at a much higher rate than it must pay for liquid molasses. The first-mentioned plants in Chicago and Iowa must pay more than twice as much inbound freight on molasses as other molasses users located in the St. Louis-Pekin area--about \$11.30 as compared with \$4.95 per ton. In addition, freight rates on the finished molasses products are almost twice as high as the rates for prepared feeds when they contain more than 60 percent grain products.

This combination of high freight rates limits the marketing area for the product. In fact, one processor said that his company could not ship east of Ohio because outbound freight rates made the finished product so expensive in comparison with grain and liquid molasses that it could not be sold in sizable quantities. The sales territory of the Louisiana processor is also limited, since his outbound freight makes the delivered price to consumers very high when his product is shipped relatively long distances, namely, north of St. Louis. This somewhat limits shipping to the heavy feeding areas where beef cattle feeding and dairy farming are the most prevalent.

The present freight rates would cause molasses dehydrators to locate their plants near molasses-consuming areas in order that they might take advantage of low ocean transportation rates for liquid molasses. Also, plants would need to be located in interior areas that have special transportation rates on liquid molasses in tankcars. For example, because of the very low freight from New Orleans to St. Louis, the producer of a dehydrated product in the latter city would experience more substantial savings in freight than would the producer in Chicago or in Kansas City.

The other major problem is a technological one. The equipment used for dehydrating molasses and combining molasses with the carrying agent is very expensive and subject to considerable breakdown. Further research is needed to develop this process so that it can be used for small-scale operation and at much lower cost. Failing such a development, the market for dehydrated molasses products is substantial enough to warrant research to discover new processing methods. Research in this field undoubtedly offers one of the basic methods for decreasing costs to consumers and enlarging the market.

Another problem, primarily a merchandising one, has been important in limiting sales in some areas. A few companies have been producing products and advertising them as dried molasses products, but they have failed to indicate the total sugar content of the products or even the type or types of industrial molasses used. Feed labeling laws require that only fat, fiber, and protein content be shown. Farmers purchase low-sugar-content products, use them in silage, and are often disappointed in results. Sales of all products of a similar type are hurt by occurrences such as these.

Direct Farm Use of Molasses

Direct utilization of molasses on farms has increased greatly during the last 2 to 3 years. Molasses is used by farmers as a preservative in grass silage, for sprinkling or spraying on dry roughage to make it more palatable, for mixing with home-grown grain and feedstuffs, and as a carbohydrate feedstuff in its liquid form to be fed from open troughs, barrels, and tanks. Direct farm use of molasses is most important in Texas, California, Florida, and the northeastern United States. During the recent survey, molasses producers and marketing agents operating in the two latter areas were interviewed to obtain information on the types of industrial molasses being used, the major uses of molasses on farms, and the distribution methods and costs.

Cane blackstrap was being marketed to farmers in large quantities in all the above-mentioned areas, whereas citrus molasses was being used on many farms in Florida. Very little beet molasses and hydrol was being fed on farms but producers of these types of molasses were beginning to show a great deal of interest in developing this outlet.

In 1951, by early fall, molasses prices to farmers and livestock feeders had increased greatly above those for the period in 1950 covered in the following discussion. However, molasses still compared favorably with the price of grain feeds delivered to these coastal areas.

Use and Marketing Margins in Florida

In Florida, both cane and citrus molasses are fed in open troughs and from tanks or sprinkled on dry roughages. Although some molasses is fed direct or on roughage to dairy cattle, the most important market is to beef cattle feeders. So far, few ranchers have installed mixing equipment in this area. Almost all molasses, both cane and citrus, is marketed direct to farms by molasses producers. Although some molasses producers own a few tanktrucks, hauling is usually done by petroleum transportation companies on a contract basis.

Cane Blackstrap Molasses

Most cane blackstrap molasses sold to large-scale farmers and ranchers in Florida is fed from large tanks, having a capacity up to 4,000 gallons, or from open concrete troughs. These tanks have either cups from which cattle can drink molasses, or regular metal troughs connected to the sides of the tank. Open concrete troughs that sit on the ground are popular and usually have a capacity of from 75 to 100 gallons.



Figure 3. Cattle eating liquid molasses from a concrete trough.

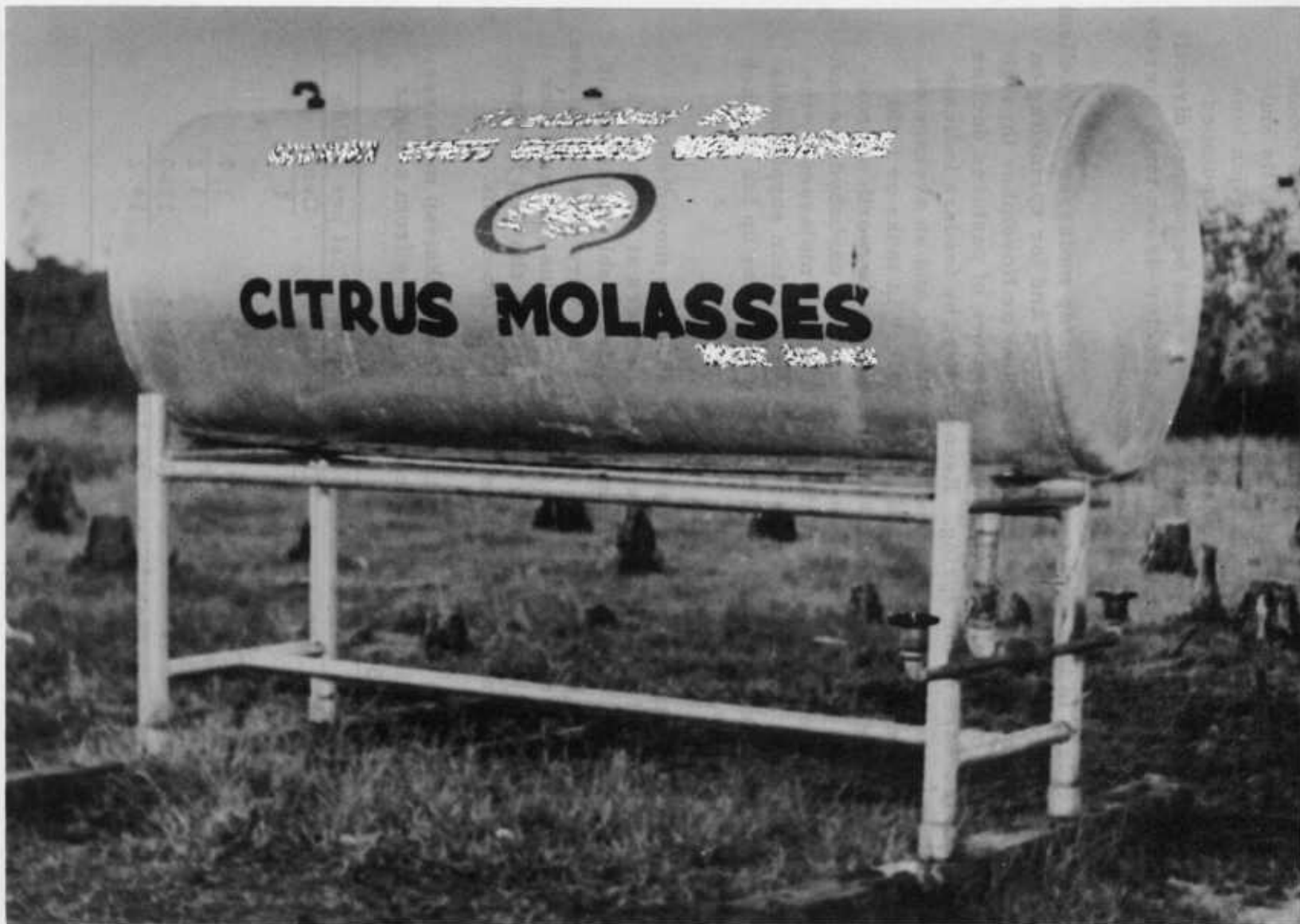


Figure 4.--Type of molasses storage and feeding tank used in Florida.

Tanks usually have open troughs at each end. The tank shown was equipped with 2 automatic feeding cups to take care of 34 head of adult bulls on pasture.

These troughs are long and narrow in order that the maximum number of cattle can be accommodated. Some ranchers are beginning to mount 600-gallon tanks on trucks for picking up molasses at sugar mills and delivering it directly to field troughs. On one farm, a 600-gallon tank was mounted on a tractor, and molasses was transported and pumped into field troughs. This works well when molasses can be pumped directly from the delivering tanktruck into the farmer's tractor-drawn tank, thereby reducing handling labor and expense to a minimum.

Cattle feeders in this area consider blackstrap molasses an excellent feed for wintering livestock, both for direct feeding and for sprinkling on roughage. This demand is seasonal, from October or November through March and depends primarily on when nutrient values of pastures decline in the fall and increase in the spring. Records kept by feeders indicate that each animal eats from 2 to 8 pounds of molasses and an average of approximately 4 pounds a day when fed "free choice" in tanks or field troughs. In this type of feeding, blackstrap is said to be worth approximately 70 percent as much as corn, on the basis of the carbohydrate content. It was pointed out frequently that cattle being fed molasses by the "free choice" method made much better gains when protein supplements such as cottonseed meal were added to the ration to make up for the lack of protein in molasses.

Truck distribution in Florida has resulted in the movement of relatively small lots of blackstrap molasses to farmers at low cost as compared with that for barreled molasses. Tanktruck shipments result in savings of from 7 to 8 cents a gallon above the delivery cost of molasses in barrels. Marketing charges were 3.2 cents per gallon for tanktruck delivery (table 17). At least 10 cents a gallon must be charged for the container and the handling of molasses sold in 50-gallon drums.

Table 17. --Approximate marketing cost of Florida blackstrap molasses, tanktruck delivery for an average of 70 miles from a sugar mill, mid-1950

| Item | : Cost per ton : | Cost per gallon |
|---------------------------------|--------------------|-----------------|
| Handling charge, 1,000-2,000 | : <u>Dollars</u> : | <u>Cents</u> |
| gallon lots | : 2.50 : | 1.5 |
| Truck transportation (including | : | : |
| pumping) | : 2.90 : | 1.7 |
| Total marketing costs | : 5.40 : | 3.2 |
| Mill price net, Florida | : 18.70 : | 11.0 |
| Delivered price in farm tank | : 24.10 : | 14.2 |

Also to be considered is the fact that farmers do not have to handle molasses if field tanks are used and handle it only a little if tanks are mounted on trucks or tractors and the molasses is pumped directly into field troughs. This has been an important sales feature since cattle feeders do not like to handle barrels or get "stuck-up" with molasses. However, molasses must be mixed with water when sprayed on the roughage-type feeds and some handling must be done regardless of the types of transportation used or the size of container in which it was purchased.

Citrus Molasses

The development of the direct farm use market for citrus molasses in Florida began during the 1948-49 citrus-processing season and did not get under way to any extent until late 1949 and early 1950. In 1948, producers of citrus molasses found that their product could not be sold except at distress prices, so they decided to try to stimulate direct farm sales. Citrus companies purchased war surplus tanks with an average capacity of from 850 to 900 gallons and placed them on farms. At least one company agreed to furnish free of charge up to 3,000 gallons of citrus molasses to demonstrate its feeding qualities. After using the free allotment, more than 90 percent of the farmers who tried it bought molasses. By mid-1950, citrus molasses producers could take only limited new orders and were concerned about not having supplies large enough to satisfy farmer demand until the new production season.

It is estimated that approximately 90 percent of the citrus molasses sold on farms was purchased by beef cattle producers and that the balance was fed on dairy farms. Citrus molasses is one of the most economical means of supplementing pasture and other roughage in wintering beef cattle and in carrying dry dairy cattle. Reasonable weight gains are made when citrus molasses and various roughages are fed in conjunction with high-quality protein and mineral supplements. Cottonseed meal is frequently used as a protein supplement when a large portion of the total livestock feed is citrus molasses. Much attention is being given to the substitution of urea for other protein supplements.

Distribution of citrus molasses has been developed on the basis of delivery by truck from the processor's plant directly to the farmer's tanks. Total marketing charges usually were about 2.7 cents a gallon in mid-1950 (table 18). The net price received by processors of citrus molasses was below that received by blackstrap molasses producers primarily because citrus firms were trying to educate their farmer-consumers



Figure 5. Beef cattle eating peanut hay to which molasses has been added.

to the merits of their product as a feed and were reluctant to increase prices rapidly. Also, because of resistance from the feed-mixing trade, the direct farm use of molasses was about the only available market for citrus molasses, whereas blackstrap producers could obtain price bids from and make sales to direct farm feeders, feed mixers, and yeast producers. As in the case of tanktruck delivery of cane blackstrap, this very economical means of distributing citrus molasses resulted in no handling difficulties for feeders. Tanktrucks drive to feeding tanks and pump molasses directly into these automatic feeding tanks. A minimum of physical handling is particularly important in the development of the direct farm feeding market.

Table 18. --Approximate marketing cost of Florida citrus molasses, tanktruck delivery for an average of 70 miles from a processing plant, mid-1950

| Item | : Cost per ton <u>1/</u> | : Cost per gallon |
|---------------------------------|--------------------------|-------------------|
| | : <u>Dollars</u> | : <u>Cents</u> |
| Handling and other charges | : 1.75 | : 1.0 |
| Truck transportation (including | : | : |
| pumping) | : 2.90 | : 1.7 |
| Total marketing cost | : 4.65 | : 2.7 |
| | : | : |
| Plant price net, Florida | : 13.00 | : 7.4 |
| Delivered price in farm tank | : 17.65 | : 10.1 |

1/ A ton of citrus molasses is equal to approximately 175 gallons.

Use and Marketing Margins in the Northeastern United States

Perhaps the area in which most progress has been made in economical delivery of small unit purchases of molasses has been in the northeastern United States, particularly New York, Pennsylvania, Massachusetts, and Maryland. In this area of relatively small farms much progress has been made in low-cost delivery of lots of molasses varying in quantity from 50 to 300 gallons. The major uses in this area are considerably different from those in Florida, California, and Texas because of the difference in types of farming and the difficult physical handling of molasses in the colder northern climate. On farms in the Northeast, molasses is used primarily to increase the palatability of coarse, rather unpalatable roughage and other home-grown feeds of low

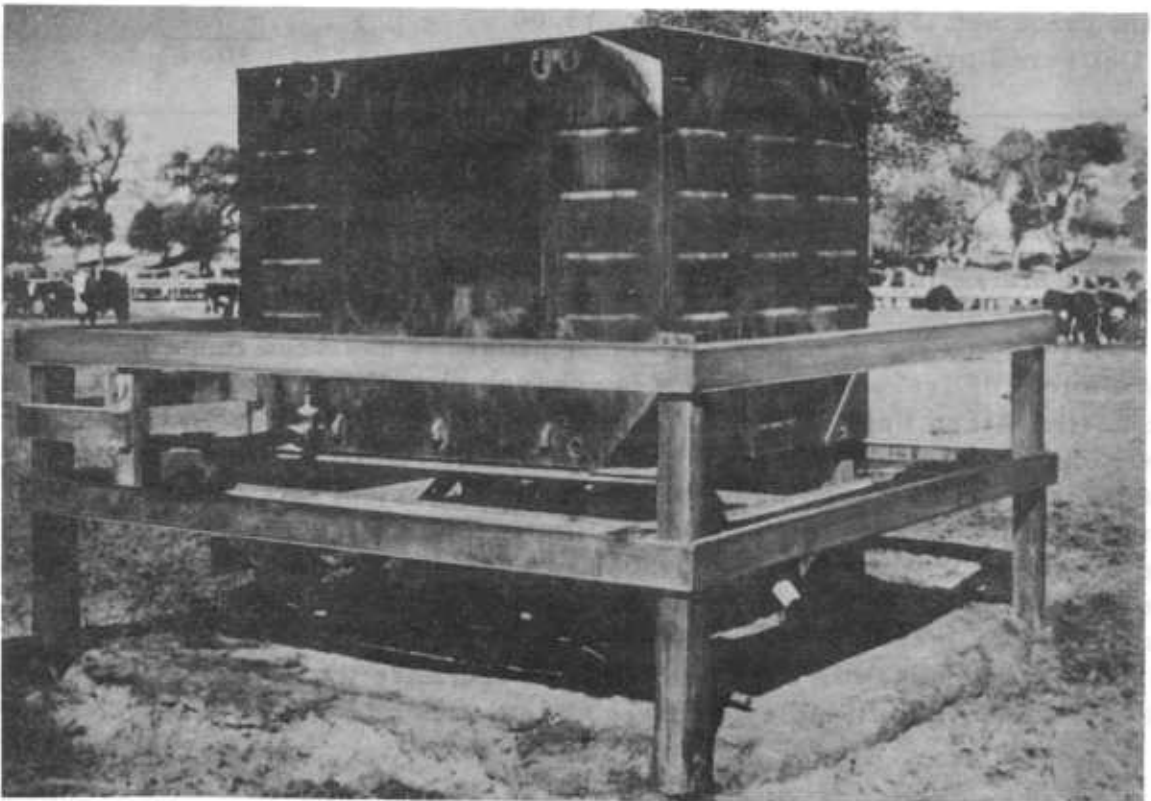
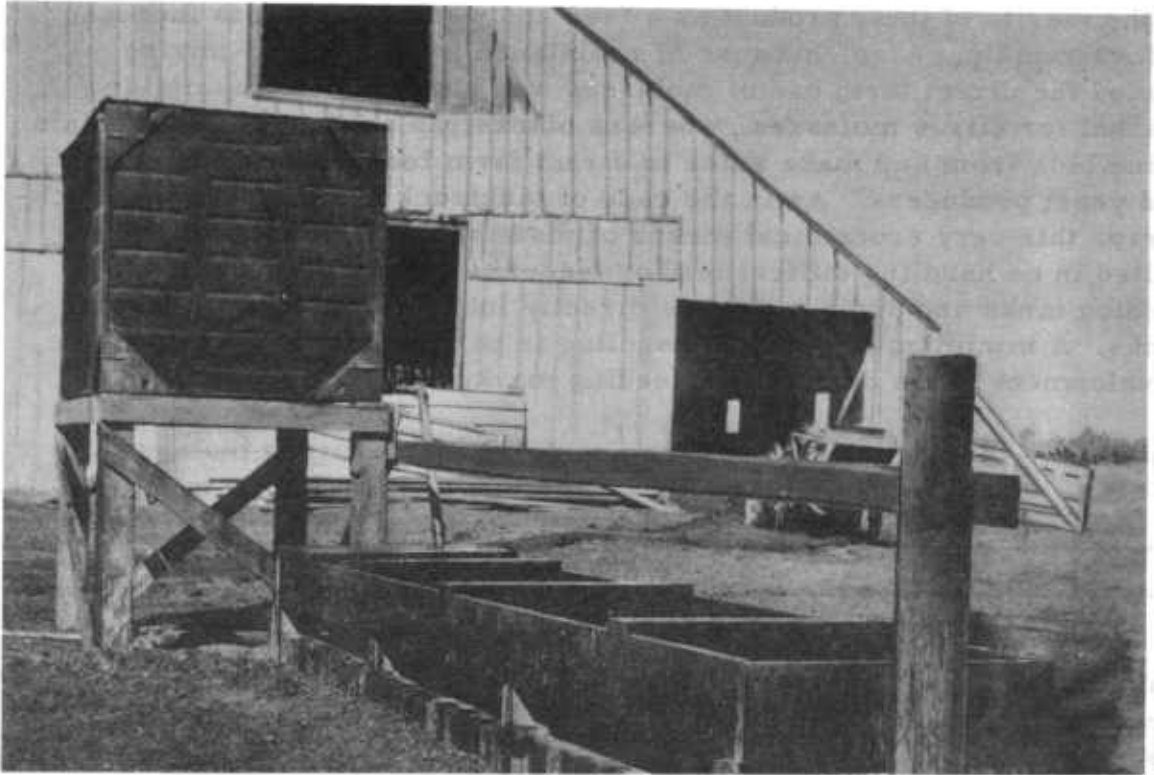


Figure 6.--Two types of molasses feeding set-ups used on the west coast.
The tanks holding 7 tons or about 1,200 gallons of molasses are equipped with float valves and the flow and feeding of molasses are completely automatic.

quality and as a preservative in making silage. This area was selected for study because the marketing procedures being followed afford information that might be useful to other market areas.

Two large cooperatives have developed truck distribution methods that have resulted in considerable savings in marketing charges as compared with the charges for small lots of molasses from retail merchants. Molasses deliveries are seldom made direct to farmers but through a member store or warehouse distribution point operated by the cooperatives. Molasses is picked up by tanktrucks in port terminals, primarily Albany, Boston, Philadelphia, and Baltimore, and carried to the distribution points mentioned. Farmers furnish their own containers and molasses is pumped directly from the tanktruck into containers. Farmers transport the product to their farms but need not be present to receive delivery of molasses since containers may be left at distribution points before arrival of delivery trucks. Tanktrucks are insulated and equipped with pumps, and molasses is preheated for ease in handling at distribution points. Although molasses is trucked up to 250 miles from port terminals, the average haul is about 100 miles.

Through the use of central tanktruck distributing points and the purchasing by farmers of molasses in whatever containers they have available, the cost of marketing in small lots has been cut to less than one-half the marketing cost of molasses delivered in barrels to retail distribution points and the purchase price of prebarreled molasses by farmers (tables 19 and 20).

Table 19. --Approximate marketing cost of delivering blackstrap molasses by tanktruck to central distributing points and cost in farmers' containers, northeastern United States, mid-1950

| Item | Cost per ton ^{1/} | Cost per gallon |
|--|----------------------------|-----------------|
| | Dollars | Cents |
| Tanktruck delivery to distribution point (100 miles) | 5.10 | 3.0 |
| Handling charge and margin at distribution point | 3.75 | 2.2 |
| Handling and transportation to farm | 3.00 | 1.8 |
| Total marketing cost | 11.85 | 7.0 |
| F. o. b. Albany | 21.30 | 12.5 |
| On-the-farm cost, in farmers' containers | 33.15 | 19.5 |

^{1/} A ton of blackstrap molasses is equal to approximately 170.2 gallons.

The major differences in marketing costs for the two types of distribution arise from higher handling costs for barreled molasses, higher transportation costs for barrels, and the use of a relatively expensive container.

Table 20. --Approximate marketing cost of delivering barreled molasses to retail distribution points and cost to farmers, northeastern United States, mid-1950

| Item | Cost per ton ^{1/} | | Cost per gallon | |
|--|----------------------------|--|-----------------|--|
| | Dollars | | Cents | |
| Barreling fee | 10.20 | | 6.0 | |
| Rail transportation | 8.50 | | 5.0 | |
| Handling charge and margin at distribution point | 3.00 | | 1.8 | |
| Handling and transportation to farm | 3.00 | | 1.8 | |
| Total marketing cost | 24.70 | | 14.6 | |
| F. o. b. Albany | 21.30 | | 12.5 | |
| On-the-farm cost in barrels | 46.00 | | 27.1 | |

^{1/} A ton of blackstrap molasses is equal to approximately 170.2 gallons.

Arrangements were being made in several northeastern States in 1950 to start direct farm feeding of liquid molasses, but this development was generally curtailed because molasses supplies became very short and prices increased to high levels. It was generally felt that this market should be approached when molasses prices were relatively low so that impetus could be gained from showing producers the economy of using molasses as a feedstuff as compared with using grain.

The greatest opportunity for increased direct farm use of molasses in the Northeast is in feeding of it to nonproducing or growing dairy cattle on hill pastures during dry summers. Winter feeding of molasses has certain physical disadvantages because of handling difficulties in cold weather. This might be overcome, to a great extent, by the installation of small indoor tanks placed above feeding troughs. Molasses could be pumped from tanktruck to the indoor tank, and gravity, plus a small amount of heat, be used to transfer molasses to feeding troughs. Handling would be cut to a minimum.

Expansion of Direct Farm Utilization

Generally, the greatest possibility for development of direct farm feeding of liquid molasses lies in areas that are near molasses production areas or in those that are near domestic port terminals. It is in these areas that marketing charges from production areas to consuming points are lowest for molasses and highest for corn and other grain. In the Midwest and other areas where the marketing costs of molasses are high because of the required long movement by rail, corn is often the cheaper feed for wintering beef cattle and other livestock or for feeding dry dairy cattle.

Although the direct feeding of liquid molasses has been started in Florida, there is room for great expansion in the tanktruck delivery system, particularly in view of the low-cost distribution systems being developed. This system of molasses distribution has been given little attention in Louisiana, Alabama, and Mississippi. The surface has barely been scratched in dairy and beef cattle areas near other port terminals, with the possible exception of the Houston and west coast terminals. Tanktruck distribution to cattle feeders also offers possibilities for market expansion in the beet molasses production areas, since the marketing charges from beet factories to feeders would be small.

There has been rapid development, particularly in the northeastern United States, in the preservation of grass silage. Most farmers use some preserving agent in silage, and the delivery of small lots of molasses as cheaply as possible offers considerable opportunity for expanding molasses utilization. The northeastern area is near port terminals, and tanktruck distribution of small lots of molasses could result in much lower on-farm molasses costs than the costs for the delivery of barreled molasses. Research should be directed toward determining the economy and the possibility of increasing the carbohydrate value of grass silage by including quantities of molasses in excess of preservation requirements.

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